## SERVICE MANUAL COMPOSITION

At present, April 1999, the **Marea-Marea Weekend 3rd volume** manual is composed of the following sections

| Print N° | Sections | Page Nos. | Comments |
|---|---|---|---|
| **506.763/09** (V/1998) | **00** | 1 - 7 | Technical data 1581 ***16v*** 98 range |
| | **10** | 1 - 64 | Fuel system 1581 ***16v*** 98 range |
| | **55** | 1 - 2 | Electrical equipment: Location of components on vehicle 1581 ***16v*** 98 range |
| | | 1 - 25 | Electrical equipment: wiring diagrams 1581 ***16v*** 98 |
| **506.763/10** (V/1998) | **33** | 1 - 17 | LUCAS Varity EBC 430 anti-lock brakes |
| **506.763/11** (VII/1998) | **10** | 1 - 12 | Fuel system 1387 ***TD*** 98 range: system with hot film flow meter |
| | **55** | Index 14/1 - 14/4 | Wiring diagrams update 1938 ***TD*** 98 range: fuel system with hot film flow meter |
| **506.763/13** (XII/1998) | **55** | Index 14/5 - 14/6 Key | Wiring diagrams update 1938 ***TD*** 98 range: Engine cooling system (from July 98) |
| **506.765/14** (IV/1999) | **00** | 1 - 71 | 99 range Technical Data |
| | | 1 - 5 | Technical data 1747 ***16v*** 98 update |
| | | 1 - 3 | Marengo 99 range Technical Data |
| | **10** | 1 - 54 | Fuel system 1242 ***16v*** |
| | | 1 - 27 | Fuel system 1387 ***JTD*** 2387 ***JTD*** |
| | | 1 - 21 | Operations on vehicle 1910 ***JTD*** 1387 ***JTD*** |
| | | 1 -42 | Fuel system 1938 ***20v*** 99 range |

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## TECHNICAL DATA

### ENGINE 1581 16v

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– Timing system components 3
– Timing diagrams 4
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## ELECTRICAL EQUIPMENT

– Starting 6

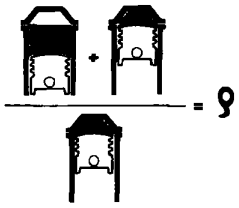
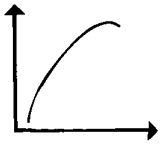
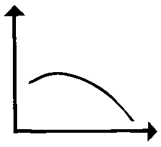
*This section contains data for vehicles fitted with the 1581 16v STEP A engine.*
*For anything not dealt with, refer to the information in the previous section 00.*

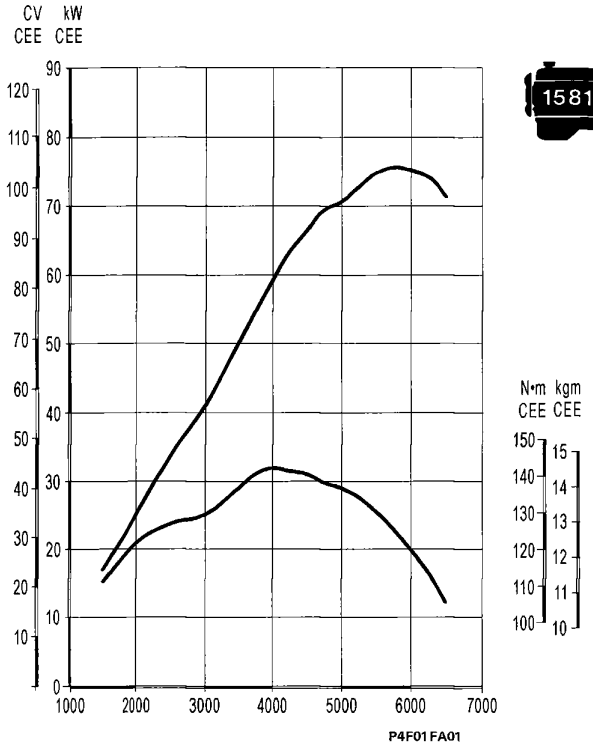
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1581 16v

## CHARACTERISTICS

| | | |
|---|---|---|
|  | Compression ratio | 10,5 ± 0,15 |
|  | Max power CEE — kW (CV) | 75,8 (103,1) |
| | Max power CEE — rpm | 5750 |
|  | Max torque CEE — daNm (kgm) | 14,2 (14,5) |
| | Max torque CEE — rpm | 4000 |




1581 16v

**Typical power curves obtained by EEC method**

The power curves illustrated can be obtained with the engine overhauled and run in, without a fan and with a silencer and air filter fitted at sea level.

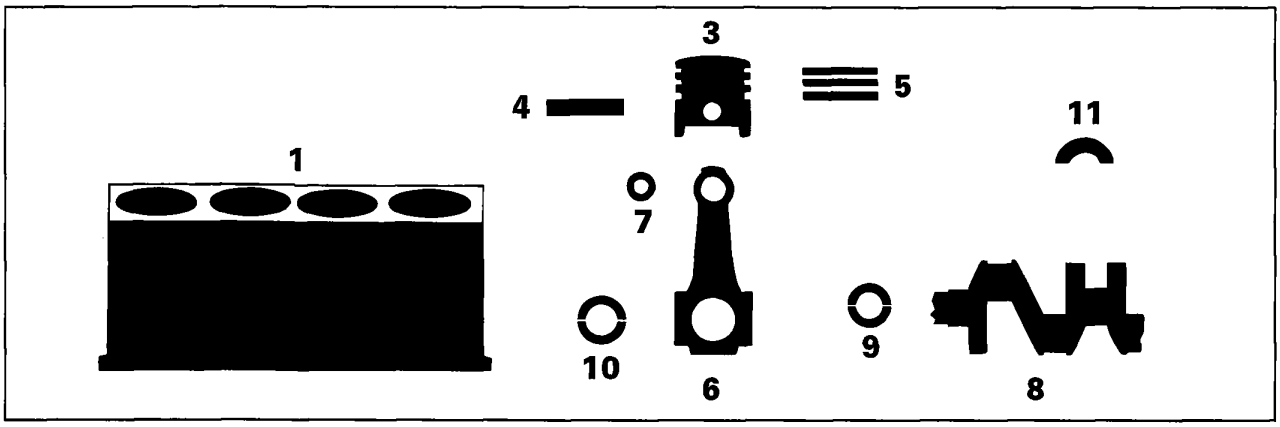
**NOTE** *The data and the curve on this page refer to the 1581 16v engine order no. 46474405*

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## 00.10

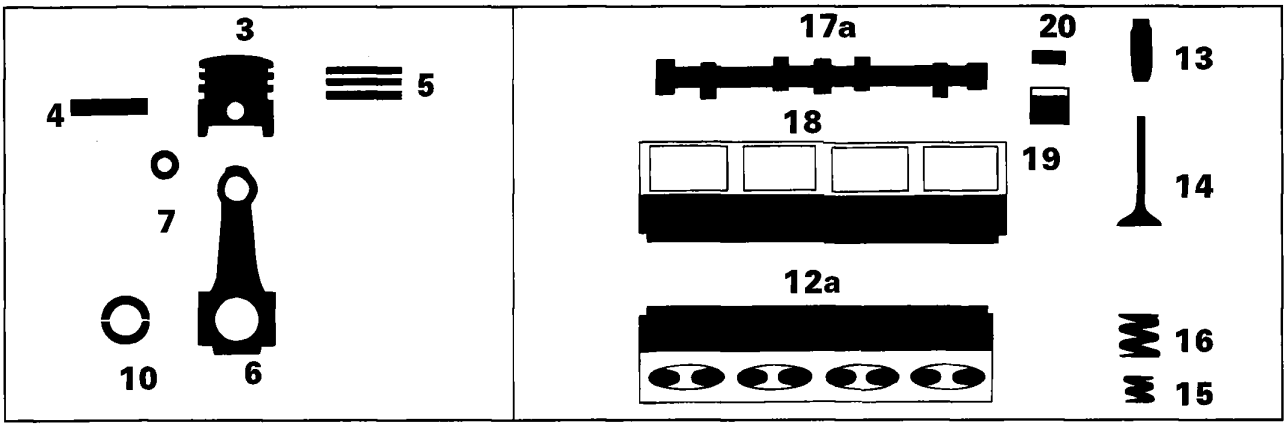



1581 16v

| DESCRIPTION | | Values in mm |
|---|---|---|
| 3 Piston | X | 10,2 |
| | A | 86,352 ÷ 86,362 |
| | B | 86,359 ÷ 86,371 |
| | C | 86,368 ÷ 86,378 |
| | Ø FIAT > | 0,4 |
| 3 Piston ring grooves | 1 | 1,520 ÷ 1,540 |
| | 2 | 1,510 ÷ 1,530 |
| | 3 | 3,010 ÷ 3,030 |
| 5 Piston rings | L 1 | 1,470 ÷ 1,490 |
| | L 2 | 1,470 ÷ 1,490 |
| | L 3 | 3,000 |
| | Ø FIAT > | 0,4 |
| 5-3 Piston rings Piston ring grooves | 1 | 0,035 ÷ 0,075 |
| | 2 | 0,020 ÷ 0,060 |
| | 3 | 0,010 ÷ 0,030 |




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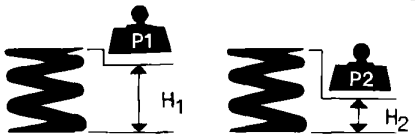
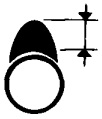
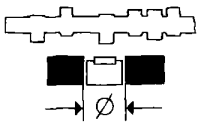



1581 16v

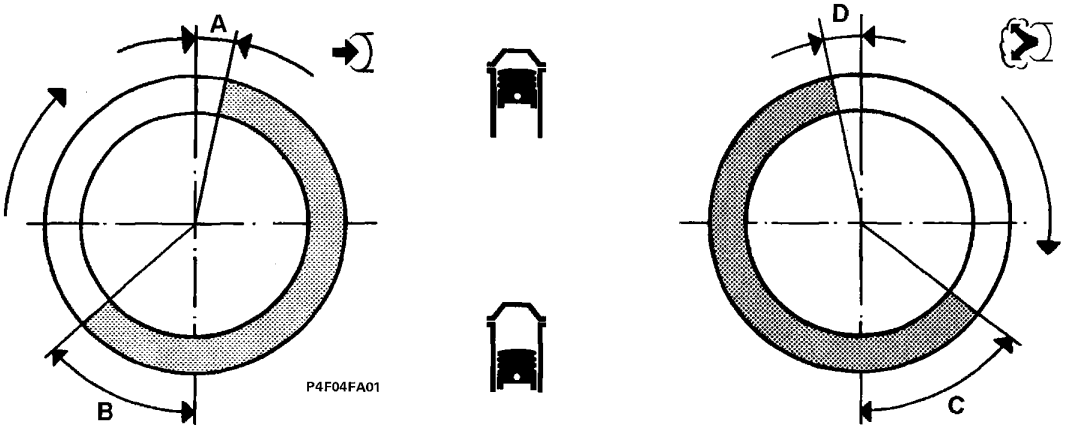
| DESCRIPTION | | Values in mm |
|---|---|---|
| 7 Small end bush | $\varnothing_1$ | 24,016÷24,041 |
| | $\varnothing_2$ | 22,004÷22,009 |
| 4-7 Gudgeon pin / Small end bush | | 0,009÷0,019 |
| Valve guide bore in cylinder head | $\varnothing$ | 12,950÷12,977 |
| 12a Valve seat | $\alpha$ | 45°±20' |
| | $\alpha$ | 45°±20' |
| | L | about 2 |
| Volume of combustion chamber in cylinder head | cc | 33,35 |
| 15 Internal valve spring | $P_1$ | 8,3÷9,3 daN |
| | $H_1$ | 27,5 |
| | $P_2$ | 17,6÷19,6 daN |
| | $H_2$ | 18,5 |



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| DESCRIPTION | | Values in mm |
|---|---|---|
| **16**   External valve spring | $P_1$ | 23,4 ÷ 25,6 daN |
| | $H_1$ | 33,5 |
| | $P_2$ | 46 ÷ 50 daN |
| | $H_2$ | 24,5 |
| **17a** **17b**  Cam lift | | 8,5 |
| | | 8 |
| **12a**  Tappet housings | Ø | 33,000 ÷ 33,025 |

## TIMING DIAGRAMS




**Timing angles**

| | | | 1581 16v |
|---|---|---|---|
| **A** | Inlet | opens ATDC | 4° |
| **B** | | closes ABDC | 38° |
| **C** | Exhaust | opens BBDC | 28° |
| **D** | | closes BTDC | 4° |




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| **INTEGRATED ELECTRONIC INJECTION/IGNITION SYSTEM COMPONENTS** | | 1581 16v |
|---|---|---|
| Electronic control unit | Versions with manual gearbox | I.A.W. 49 F.B6 |
| | Versions with automatic gearbox | I.A.W. 49 F.L3 |
| Intake air temperature and pressure sensor | | M.Marelli TPRT 03 |
| Fuel vapour solenoid valve | | SIEMENS EC1 |
| Butterfly casing | | M.Marelli 46 SX F2 |
| Idle adjustment actuator | | M. Marelli IB/02 |
| Injector | | M.Marelli IWP 064 |
| Fuel pressure regulator | | M.Marelli RPM 84 |
| Coolant temperature sender unit | | JAEGER 402.183.01<br>ELTH Z690350 |
| TDC and rpm sensor | | JAEGER CVM 02 |
| Butterfly valve position sensor (potentiometer) | | M. Marelli IPF 2C |
| Twin relay feed for electric fuel pump and injection/ignition control unit | | BITRON |
| Electric fuel pump | | MARWALL ESS 291 |
| Lambda sensor | | NTK 0ZA 334-A1 |
| Fuel filter | | MARWALL FA 5325 IN |
| Detonation sensor | | NTK KNE 03 |
| Ignition coils | | COOPER BAE 920 A |

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| STARTER MOTOR | | 1581 16v |
|---|---|---|
| Type | | M. Marelli<br>M70R-12V-1,3 kW (with reduction gear) |
| Voltage | V | 12 |
| Nominal power | kW | 1,3 |
| Rotation, pinion side | | clockwise |
| No. of poles | | 4 |
| Field coil | | winding series-parallel |
| Engagement | | free wheel |
| Operation | | solenoid |
| End float of armature shaft | mm | 0,15 ÷ 0,45 |
| **Data for bench test** | | |
| Operating test (*): | | |
| current | A | 360 ÷ 380 |
| speed | rpm | 1150 |
| voltage | V | 8,15 |
| torque developed | daNm | 1,30 |
| Engagement test (*): | | |
| current | A | 680 ÷ 700 |
| voltage | V | 4,9 |
| torque developed | daNm | 3,11 |
| Free running test (*): | | |
| current | A | 60 ÷ 80 |
| voltage | V | 11,1 |
| speed | rpm | 4040 |
| **Relay** | | |
| Winding resistance (*) | pull in Ω | 0,33 ÷ 0,37 |
| | hold in Ω | 1,13 ÷ 1,27 |
| **Lubrication** | | |
| Internal splines and shaft bushes | | VS+ SAE 10 W |
| Engagement sleeve and intermediate disc | | TUTELA MR3 |

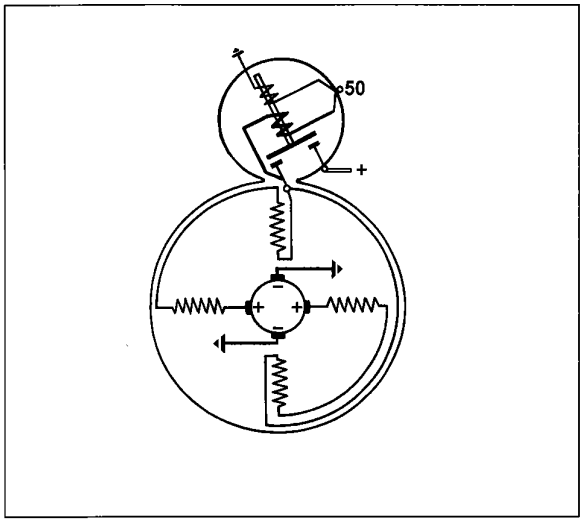
(*) Data obtained at an ambient temperature of 20°C.

**NOTE** *When overhauling, it is not advisable to undercut the insulator between the commutator bars*



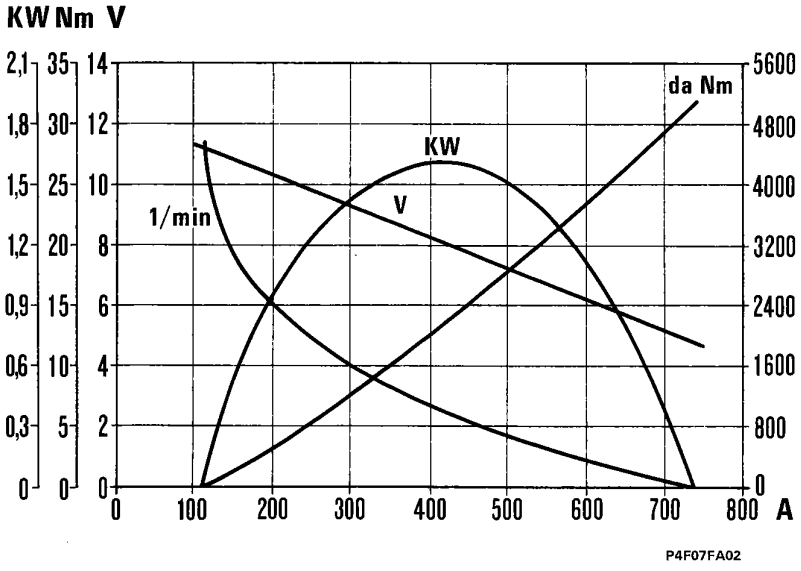

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## STARTER MOTOR - WIRING DIAGRAM AND TYPICAL CURVES




P4F07FA01

**Starter motor wiring diagram for M. Marelli M70R-1,3/12**




P4F07FA02

**Typical curves for starter motor M. Marelli M70R-1,3/12 (with epicyclic reduction gear)**



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| | CHASSIS | ENGINE | VERSION | MAREA | MAREA WEEKEND | GEARBOX | |
|---|---|---|---|---|---|---|---|
| 1242 16v | ZFA 185 000 | 182 B2.000 | 185 AX P1A 17 | ● | | ● | |
| | | | 185 BX P1A 18 | | ● | | |
| 1581 16v | | 182 A4.000 | 185 AX B1A 01 | ● | | ● | |
| | | | 185 AX B1A 01B (▲) | ● | | | |
| | | | 185 AX B1A 01C (■) | ● | | | |
| | | | 185 BX B1A 05 | | ● | | |
| | | | 185 BX B1A 05B (▲) | | ● | | |
| | | | 185 BX B1A 05C (■) | | ● | | |
| | | | 185 AX B11 08 | ● | | | ● |
| | | | 185 BX B11 12 | | ● | | |
| 1747 16v | | 182 A2.000 | 185 AX C1A 02 | ● | | ● | |
| | | | 185 AX C1A 02B (▲) | ● | | | |
| | | | 185 AX C1A 02C (■ | ● | | | |
| | | | 185 BX C1A 06 | | ● | | |
| | | | 185 BX C1A 06B (▲) | | ● | | |
| | | | 185 CX C1A 06C (■ | | ● | | |
| 1998 20v | | 182 B7.000 | 185 AX M1A 19 | ● | | ● | |
| | | | 185 AX M1A 19B (■ | ● | | | |
| | | | 185 BX M1A 20 | | ● | | |
| | | | 185 BX M1A 20B (■ | | ● | | |
| 1910 TD 75 | | 182 A8.000 | 185 AX F1A 10 | ● | | ● | |
| | | | 185 AX F1A 14 | | ● | | |
| 1910 JTD | | 182 B4.000 | 185 AX N1A 21 | ● | | ● | |
| | | | 185 BX N1A 22 | | ● | | |
| 2387 JTD | | 185 A6.000 | 185 AX Q1A 23 | ● | | ● | |
| | | | 185 BX Q1A 24 | | ● | | |

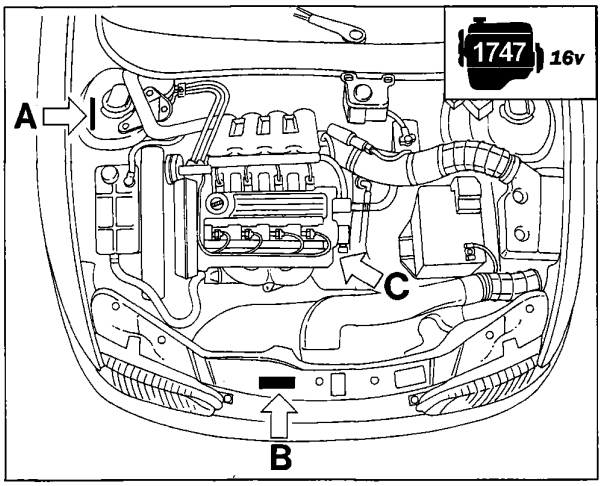
(▲) Versions for specific markets (France)  (■) Voluntary for Germany

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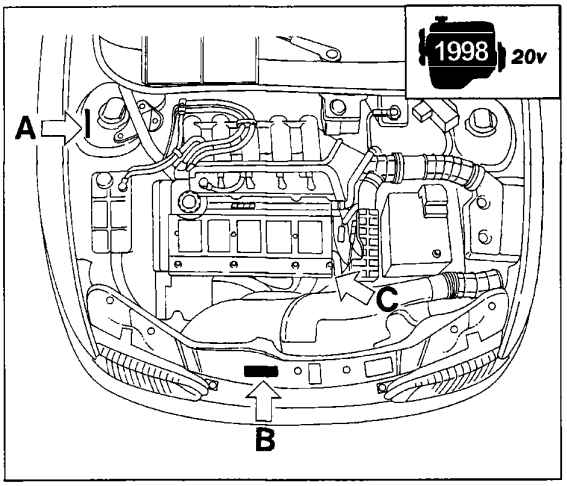


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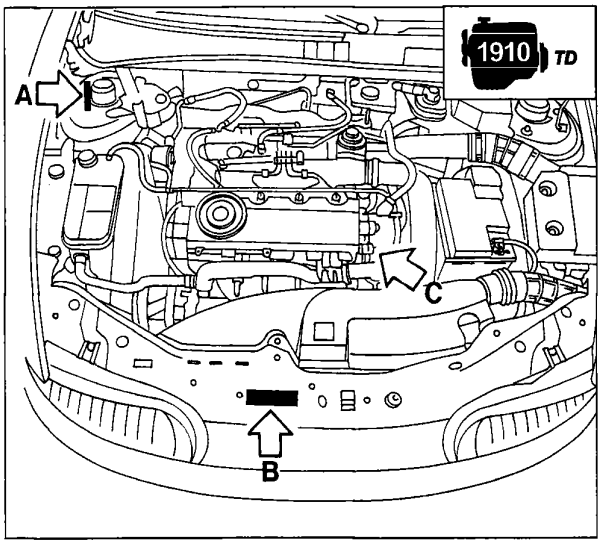
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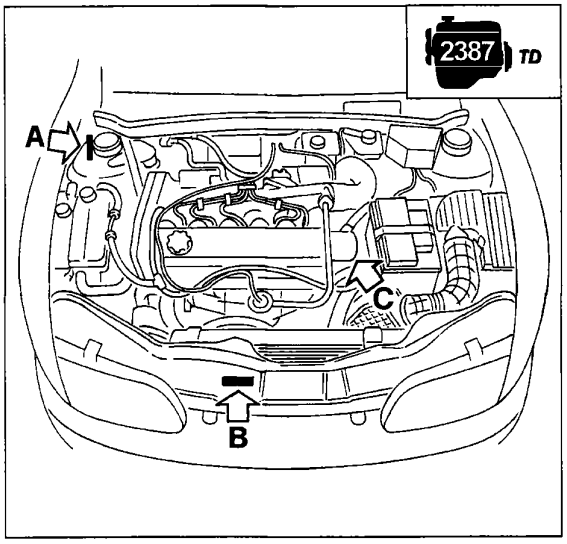

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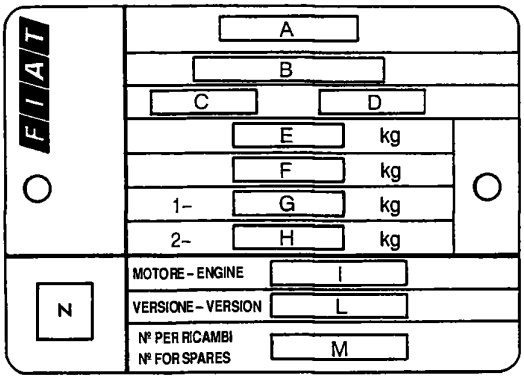



P4F003A03




P4F003A04

A. Vehicle type identification code and chassis number
B. V.I.N. Plate (EEC regulations)
C. Engine type and number




P3F003A01

A. Name of manufacturer
B. Homologation number
C. Vehicle type identification code
D. Chassis manufacture number
E. Maximum authorized weight of vehicle fully laden
F. Maximum authorized weight of vehicle fully laden plus trailer
G. Maximum authorized weight on first axle (front)
H. Maximum authorized weight on second axle (rear)
I. Engine type
L. Bodywork version code
M. Spares number
N. Correct value of smoke absorption coefficient (for Diesel engines only)




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| ENGINE TYPE | 1242 16v | 1581 16v | 1747 16v | 1998 20v | 1910 TD 75 | 1910 JTD | 2387 JTD |
|---|---|---|---|---|---|---|---|
| *Marea* | 1085 | 1140<br>1165 (▼) | 1195 | 1255 | 1185 | 1215 | 1295 |
| *Marea Weekend* | 1145 | 1200<br>1225 (▼) | 1255 | 1315 | 1245 | 1275 | 1355 |
| *Marea* +590= (575)* 240 / 225 * | 1675 | 1730<br>1755 (▼ | 1785 | 1830 | 1775 | 1805 | 1870 |
| *Marea Weekend* +595= (580)** 245 / 230 ** | 1740 | 1795<br>1820 (▼) | 1850 | 1895 | 1840 | 1870 | 1950 |
| Permissible loads on the axles ■ | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 |
| | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 |
| Maximum permissible load on the roof | 80 | 80 | 80 | 80 | 80 | 80 | 80 |
| Load on the tow hook (trailer with braking system) | 70 | 70 | 70 | 70 | 70 | 70 | 70 |
| Without braking system | 400 | 400 | 400 | 400 | 400 | 400 | 400 |
| With braking system | 1200 | 1200 | 1200 (1300)● | 1300 (1400)● | 1300 | 1300 | 1400 |

■ Loads which must never be exceeded
(*) Specific figures for 1998 20v and 2387 JTD versions
(**) Specific figures for 1998 20v version
(●) Specific figures for the Marea Weekend
(▼) Specific figures for the 1581 16v c.a. version

**NOTE FOR VERSIONS WITH ACCESSORIES:** In the presence of special equipment (non standard air conditioning, sun roof, trailer towing device, etc.), the empty weight increases and therefore the carrying capacity may decrease in relation to the maximum permissible loads.

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| ENGINE TYPE | | 1242 16v | 1581 16v | 1581 16v C.A. | 1747 16v | 1998 20v |
|---|---|---|---|---|---|---|
| Speed km/h (average load)  | 1 | 41 | 46 | MAX 187 (185)* | 49 | 59 |
| | 2 | 74 | 80 | | 85 | 94 |
| | 3 | 108 | 124 | | 125 | 139 |
| | 4 | 142 | 173 | | 164 | 182 |
| | 5 | 172 (171)* | 187 (185)* | | 195 (193)* | 210 (208)* |
| | R | 41 | 46 | | 49 | 54 |
| (*) For Marea Weekend version | | | | | | |
|  Max. climable gradient fully laden | Marea | 34 | 36 | 32 | 38 | 39 |
| | Marea Weekend | 31 | 33 | 30 | 35 | 36 |
|  Fuel consumption in accordance with directive 93/116/CE (litres/100 km) — Urban | Marea | 9.8 | 11.3 | 13.8 | 11.5 (11.2)● | 14.2 |
| | Marea Weekend | 10 | 11.5 | 14.1 | 11.8 (11.5)● | 14.3 |
| Extra-urban | Marea | 5.6 | 6.6 (6.5)● | 8.3 | 6.6 (6.3)● | 7.3 |
| | Marea Weekend | 5.8 | 6.6 (6.5)● | 8.5 | 6.8 (6.5)● | 7.4 |
| Combined | Marea | 7.2 | 8.3 (8.2)● | 10.3 | 8.4 (8.1)● | 9.8 |
| | Marea Weekend | 7.3 | 8.4 (8.3)● | 10.6 | 8.6 (8.3)● | 9.9 |
| $CO_2$ exhaust emissions (g/km) | Marea | 170 | 197 (195)● | 246 | 199 (192)● | 234 |
| | Marea Weekend | 173 | 200 (198)● | 251 | 205 (198)● | 237 |

The fuel consumption figures in accordance with directive 93/116/CE have been defined during the course of homologation tests which include:

- an urban cycle which includes a cold start followed by a simulated urban cycle.
- an extra-urban cycle which includes frequent acceleration in all gears simulating normal out of town usage of the vehicle. The speed varies between 0 and 120 km/h.
- the average combined consumption includes 37% of the urban cycle and 63% of the extra-urban cycle.

The type of route, traffic conditions, driving style, weather conditions, trim level/equipment/accessories, presence of special equipment and the state of the vehicle in general can lead to different fuel consumption figures from those established using the above mentioned procedures.

The C02 exhaust emissions (in g/km) are measured during the average combined cycle.

(☆) Versions for specific markets (France)



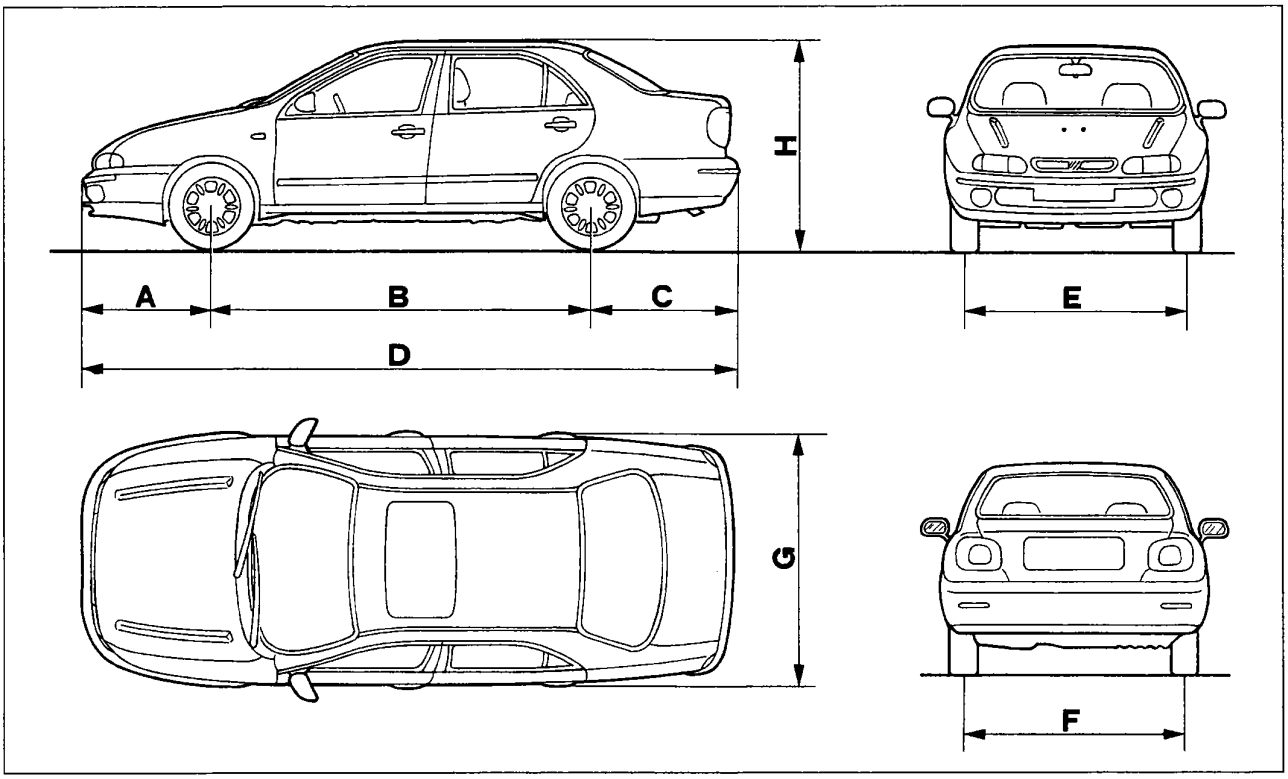

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| | | ENGINE TYPE | 1910 TD 75 | 1910 JTD | 2387 JTD |
|---|---|---|---|---|---|
| Speed km/h (average load)  (*) For Marea Weekend | | 1 | 36 | 36 | 36 |
| | | 2 | 62 | 52 | 62 |
| | | 3 | 96 | 97 | 101 |
| | | 4 | 135 | 136 | 141 |
| | | 5 | 167 (165)* | 185 (183)* | 197 (195)* |
| | | R | 36 | 36 | 39 |
|  | Max. climable gradient fully laden | *Marea* | 37 | 40 | 41 |
| | | *Marea Weekend* | 34 | 37 | 38 |
|  Fuel consumption figures in accordance with directive 93/116/CE (litres/100 km) | Urban | *Marea* | 8.5 | 7.4 | 9.0 |
| | | *Marea Weekend* | 8.7 | 7.5 | 9.1 |
| | Extra-urban | *Marea* | 5.1 | 4.6 | 5.6 |
| | | *Marea Weekend* | 5.3 | 4.7 | 5.7 |
| | Combined | *Marea* | 6.4 | 5.6 | 6.7 |
| | | *Marea Weekend* | 6.5 | 5.7 | 6.8 |
| $CO_2$ exhaust emissions (g/km) | | *Marea* | 169 | 149 | 177 |
| | | *Marea Weekend* | 173 | 151 | 180 |



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# 00.0



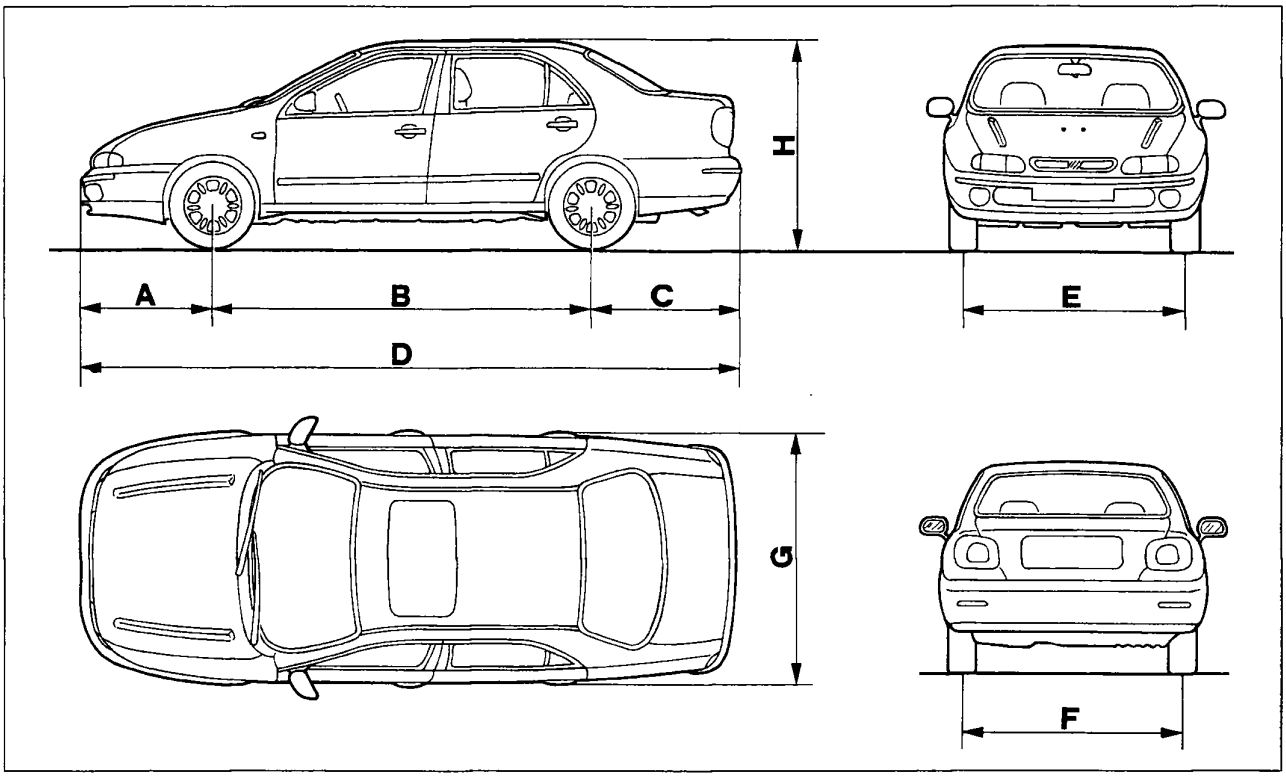

P4F008A01

Luggage compartment capacity (VDA regulations): 430 $dm^3$
The height refers to an unladen vehicle

| Engine types | Wheel rim | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|---|
| 1242 16v | 5½Jx14-37<br>6Jx15-43 | 881 | 2540 | 969 | 4390 | 1480<br>1470 | 1455<br>1440 | 1741 | 1425 |
| 1581 16v | 5½Jx14-43<br>6Jx15-43 | 881 | 2540 | 969 | 4390 | 1470<br>1470 | 1440<br>1440 | 1741 | 1425 |
| 1387 16v C.A. | 5½Jx14-43<br>6Jx15-43 | 881 | 2540 | 969 | 4390 | 1470<br>1470 | 1440<br>1440 | 1741 | 1425 |
| 1747 16v | 5½Jx14-43<br>6Jx15-43 | 881 | 2540 | 969 | 4390 | 1470<br>1470 | 1440<br>1440 | 1741 | 1425 |
| 1998 20v | 6Jx15-49 | 881 | 2540 | 969 | 4390 | 1475 | 1430 | 1741 | 1420 |
| 1387 TD | 5½Jx14-37<br>6Jx15-43 | 884 | 2540 | 969 | 4393 | 1480<br>1470 | 1455<br>1440 | 1741 | 1425 |
| 1910 JTD | 5½Jx14-43<br>6Jx15-43 | 884 | 2540 | 969 | 4393 | 1470<br>1470 | 1440<br>1440 | 1741 | 1425 |
| 1387 JTD | 5½Jx15-46 | 884 | 2540 | 969 | 4393 | 1480 | 1435 | 1741 | 1420 |




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P4F008A01

| Engine types | Wheel rim | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|---|
| 1242 16v | 5½Jx14-37<br>6Jx15-43 | 881 | 2540 | 1066 | 4487 | 1480<br>1470 | 1455<br>1440 | 1741 | 1510 |
| 1581 16v | 5½Jx14-43<br>6Jx15-43 | 881 | 2540 | 1066 | 4487 | 1470<br>1470 | 1440<br>1440 | 1741 | 1510 |
| 1581 16v C.A. | 5½Jx14-43<br>6Jx15-43 | 881 | 2540 | 1066 | 4487 | 1470<br>1470 | 1440<br>1440 | 1741 | 1510 |
| 1747 16v | 5½Jx14-43<br>6Jx15-43 | 881 | 2540 | 1066 | 4487 | 1470<br>1470 | 1440<br>1440 | 1741 | 1510 |
| 1998 20v | 6Jx15-49 | 881 | 2540 | 1066 | 4487 | 1475 | 1430 | 1741 | 1505 |
| 1910 TD | 5½Jx14-37<br>6Jx15-43 | 884 | 2540 | 1066 | 4490 | 1480<br>1470 | 1455<br>1440 | 1741 | 1510 |
| 1910 JTD | 5½Jx14-43<br>6Jx15-43 | 884 | 2540 | 1066 | 4490 | 1470<br>1470 | 1440<br>1440 | 1741 | 1510 |
| 2387 JTD | 5½Jx15-46 | 884 | 2540 | 1066 | 4490 | 1480 | 1435 | 1741 | 1505 |



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## 00.0

| Description | Units | dm³ (l) | kg | 1242 16v | 1581 16v | 1747 16v | 1998 20v |
|---|---|---|---|---|---|---|---|
| Petrol ⩾ O.R. 95 Unleaded | | • | | 63 | 63 | 63 | 63 |
| 50% + (▲) | Total capacity of cooling system | • | | 6 (5.6 ■) | 7 (6.7 ■) | 6 (5.6 ■) | 7.6 (7.4 ■) |
| Petrol engines SELENIA 20K (SAE 10W/40) | Total capacity | • | | 3.1 | 4.5 | 4.6 | 5.5 |
| | | | • | 2.75 | 4 | 4.1 | 4.7 |
| | Partial capacity (periodic replacement) | • | | 2.8 (2.5*) | 3.8 (3.5*) | 4.3 (3.9*) | 5 (4.5*) |
| | | | • | 2.5 (2.25*) | 3.4 (3.1*) | 3.85 (3.5*) | 4.45 (4*) |
| TUTELA ZC 75 Synth | | • | | 1.7 | 1.98 | 1.65 | 1.98 |
| | | | • | 1.5 | 1.8 | 1.5 | 1.8 |
| TUTELA GI/2 | | • | | - | 4.3 | - | - |
| | | | • | - | 3.9 | - | - |

(▲) Distilled water
(■) For versions with air conditioning
(*) Engine sump only




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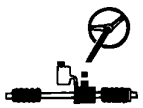
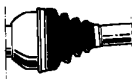
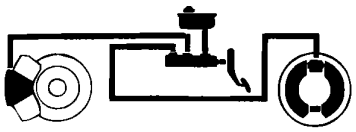
| Description | Units | dm³ (l) | kg | 1910 TD 75 | 1910 JTD | 2387 JTD |
|---|---|---|---|---|---|---|
| Diesel | | • | | 63 | 63 | 63 |
| 50% + (▲) | Total capacity of cooling system | • | | 6 (5.6 ■) | 6 (5.6 ■) | 7.6 (7.4 ■) |
| Diesel Engines SELENIA Turbo Diesel (SAE 15W/40) | Total capacity | • | | 4.7 | 4.8 | 5.5 |
| | | | • | 4.2 | 4.25 | 4.7 |
| | Partial capacity (periodic replacement) | • | | 4.5 (4.2*) | 4.3 (4*) | 5 (4.7*) |
| | | | • | 4 (3.75*) | 3.75 (3.55*) | 4.45 (4.2*) |
| TUTELA ZC 75 Synth | | • | | 1.65 | 1.65 | 1.98 |
| | | | • | 1.5 | 1.5 | 1.8 |

(▲) Distilled water
(■) For versions with air conditioning
(*) Engine sump only



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## 00.0

| Description | Units | | | Quantity dm³ (l) | Quantity kg |
|---|---|---|---|---|---|
| TUTELA GI/A |  | | | - | 0.8 |
| TUTELA MRM2 |  | | | - | 0.003 |
| TUTELA TOP4 (270°C) |  Total capacity | | without ABS | 0.40 | - |
| | | | without ABS | 0.45 | - |
| + AREXONS | ☼ | 30% |  | 5 | - |
| | ❄ - 10°C | 50% | | | |
| | ❄ - 20°C | 100% | | 6.4▲ (6.8 ●) | - |

▲ Marea Weekend
(●) For the Marea Weekend 1747 16v - 1910 TD - 1910 JTD versions




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| Name of product | Description International designation | Application |
|---|---|---|
| SELENIA 20K | Semi-synthetic SAE 10W40 multigrade engine oil. Exceeds specifications ACEA A3-96/CCMC G5 and API SH | Temperature - 25°C - 40°C |
| SELENIA Turbo SAE 15W/40 Diesel | Mineral or semi-synthetic SAE 15W40 multigrade engine oil. Exceeds specifications ACEA B3-96/CCMC PD2 and API CD | Temperature - 15°C - 40°C (*) |
| TUTELA ZC75 SYNTH | SAE 75W EP oil. Satisfies standards MIL-L-2105 D and API GL 5 | Manual gearboxes and differentials |
| TUTELA GI/A | "DEXRON II" type oil for hydraulic power assisted steering | Hydraulic power assisted steering |
| TUTELA GI/2 | "DEXRON II" type oil for automatic transmissions | Automatic gearboxes |
| TUTELA MRM2 | Water repellant, lithium soap based grease containing molybdenum disulphide, consistency NLGI = 2 | Constant velocity joints |
| TUTELA TOP 4 | Synthetic fluid, F.M.V.S.S. n° 116 DOT 4 ISO 4925, CUNA NC 956-01 | Hydraulic brakes and hydraulically operated clutches |
| Arexons DP1 | Mixture of alcohol, water and surface active agents CUNA NC 956-11 | To be used undiluted or diluted in windscreen washer systems |
| Paraflu[11] | Anti-freeze for cooling systems with mono-ethylene glycol base CUNA NC 956-16 | Cooling circuits Percentage to be used 50% up to –35°C |
| Diesel Mix Arexons | Additive for diesel fuel with protective action for Diesel engines | To be mixed with diesel fuel (25 cc per 10 litres) |

(*) For temperatures below –15°C, use SAE 10W40 grade oils



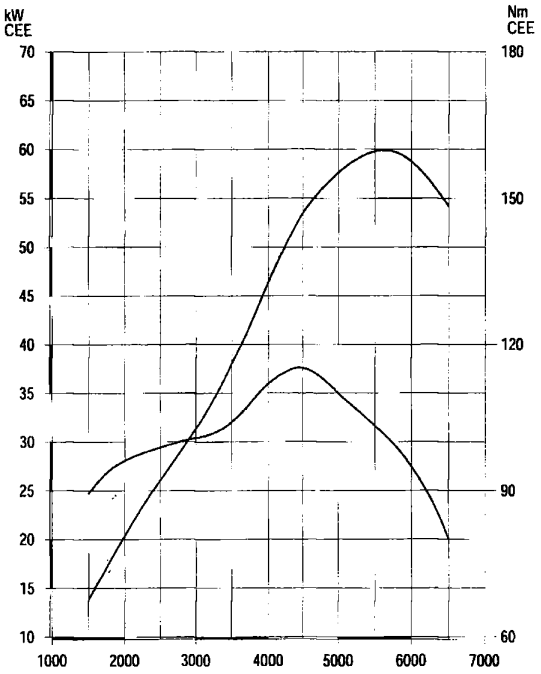
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| SPECIFICATIONS | | | 1242 16v | 1998 20v |
|---|---|---|---|---|
| | Cycle | | OTTO 4 stroke | |
| | Timing | | TOHC | |
| | Type of fuel system | | Integrated electronic injection - ignition | |
| | Number of cylinders | | 4 | 5 |
| | Cylinder liner (bore) | mm | 70.80 | 82 |
| | Stroke | mm | 78.86 | 75.65 |
| | Capacity | $cm^2$ | 1242 | 1998 |
| | Compression ratio | | 10.2 | 10.7 ± 0.15 |
| Max power CEE | | kW (CV) | 60 82 | 113 154 |
| | | rpm | 5500 | 6500 |
| Max torque CEE | | daNm (kgm) | 11.3 11.5 | 18.6 (19.2) |
| | | rpm | 4250 | 3750 |

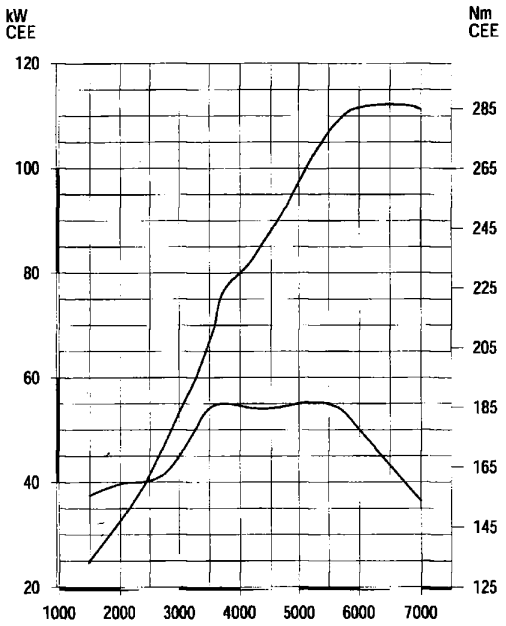



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1242 **16v**




1998 **20v**




**Power curves obtained through the CEE method**

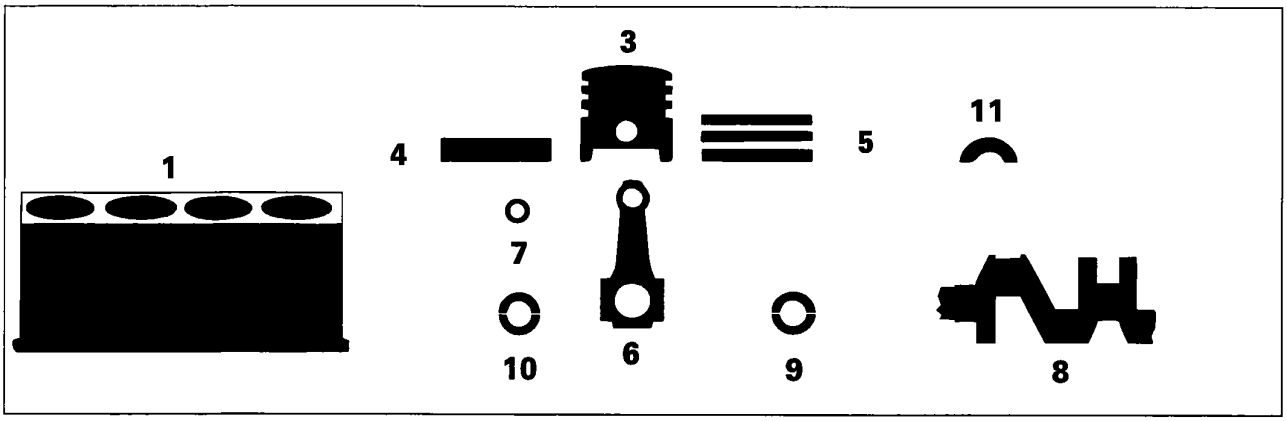
The power curves illustrated are those obtained using overhauled engines which have been run in, without a fan and with an exhaust silencer and air filter fitted, at sea level.

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## 00.10




| DESCRIPTION | | | 1242 16v | 1998 20v |
|---|---|---|---|---|
| | | | Values in mm | |
| 1 | Main bearing supports | L | 19.14-19.20 | 21.72-21.80 |
| | | Ø 1 | 51.705-51.709 | 63.705-63.718 |
| | | Ø 2 | 51.709-51.713 | |
| | | Ø 3 | 51.713-51.717 | |
| 1 | Ø Cylinder liner/bore | A | 70.800-70.810 | 82.000-82.010 |
| | | B | 70.810-70.820 | 82.010-82.020 |
| | | C | 70.820-70.830 | 82.020-82.030 |
| 3 | Piston | X | 6 | 12.5 |
| | | Ø A | 70.760-70.770 | 81.952-81.962 |
| | | Ø B | 70.770-70.780 | 81.959-81.971 |
| | | Ø C | 70.780-70.790 | 81.968-81.978 |
| | Ø FIAT > | | 0.4 | |
| 3 | Difference in weight between pistons | | ± 5 g | |
| 3-1 | Piston Cylinder liner/bore Ø | A | 0.030-0.050 | 0.038-0.058 |
| | | B | | 0.039-0.061 |
| | | C | | 0.042-0.062 |

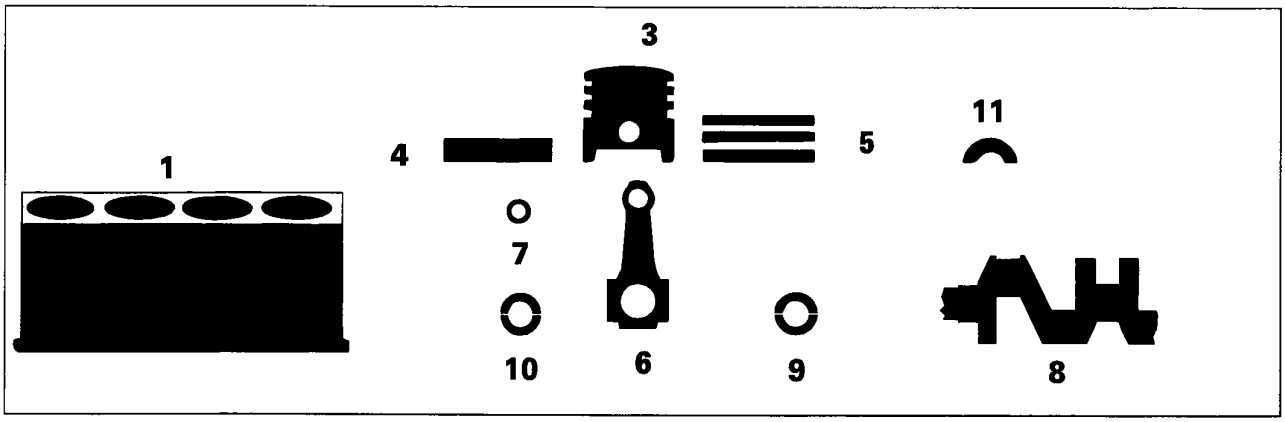



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| DESCRIPTION | | 1242 16v | 1998 20v |
|---|---|---|---|
| | | Value in mm | |
| 3 Gudgeon pin housing | Ø | 17.982-17.986 | 20.002-20.007 |
| 4 | Ø | 17.970-17.974 | 19.996-20.000 |
| Gudgeon pin | Ø FIAT > | 0.2 | |
| 4-3 Gudgeon pin - Housing | | 0.008-0.016 | 0.002-0.011 |
| 3 Piston Ring Grooves | 1 | 1.190-1.230 | 1.220-1.240 |
| | 2 | 1.190-1.230 | 1.210-1.230 |
| | 3 | 2.490-2.530 | 2.010-2.030 |
| 5 Piston rings | 1 | 1.170-1.190 | 1.180-1.160 |
| | 2 | 1.175-1.190 | 1.190-1.170 |
| | 3 | 2.475-2.490 | 1.990-1.970 |
| | Ø FIAT > | 0.4 | |
| 5-3 Piston rings Piston ring grooves | 1 | 0-0.06 | 0.040-0.080 |
| | 2 | 0-0.055 | 0.020-0.050 |
| | 3 | 0-0.055 | 0.020-0.060 |
| 5-1 Opening at end of piston rings in cylinder liner | 1 | 0.200-0.400 | 0.200-0.350 |
| | 2 | 0.250-0.450 | 0.250-0.500 |
| | 3 | 0.200-0.450 | 0.250-0.500 |
| 6 Small end bush or pin housing | Ø1 | 17.939-17.956 | 22.939-22.972 |
| Big end bearing housing | Ø2 | 45.128-45.138 | 51.354-51.366 |

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| DESCRIPTION | | | 1242 16v | 1998 20v |
|---|---|---|---|---|
| | | | Values in mm | |
| 4-6 | Gudgeon pin - small end | | 0.014-0.035 | - |
| 7 | Small end bush | Ø1 | - | 23.007-23.027 |
| | | Ø 2 | - | 20.006-20.012 |
| 4-7 | Gudgeon pin Small end bush | | - | 0.006-0.020 |
| 7-6 | Small end bush Bush housing | | - | 0.035-0.088 |
| 8 | Main journals | Ø1 — 1 | 47.982-47.988 | 59.994-60.000 |
| | | Ø1 — 2 | 47.988-47.994 | 59.988-59.990 |
| | | Ø1 — 3 | 47.994-48.000 | 59.982-59.980 |
| | Crank pins | Ø1 — A | 41.990-42.008 | 48.238-48.240 |
| | | Ø1 — B | - | 48.232-48.230 |
| | | Ø1 — C | - | 48.226-48.230 |
| | | L1 | 23.975 - 24.025 | 26.575-26.625 |




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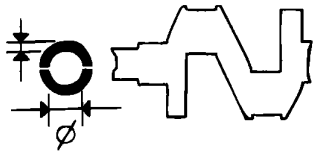
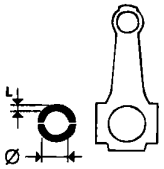
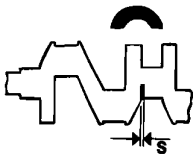
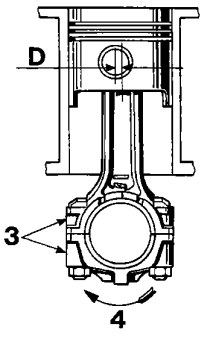
| DESCRIPTION | | 1242 16v | 1998 20v |
|---|---|---|---|
| | | Values in mm | |
| 9 Crankshaft bearings  | L 1 | 1.836-1.840 | 1.836-1.840 |
| | L 2 | 1.843-1.847 | 1.839-1.843 |
| | L 3 | 1.848-1.852 | 1.842-1.846 |
| | ø FIAT < | 0.254 - 0.508 | |
| 9-8  Big end bearings - Main journals | | 0.025-0.040 | 0.025-0.052 |
| 10  Big end housing | L A | 1.544-1.548 | 1.536-1.540 |
| | L B | | 1.539-1.543 |
| | L C | | 1.542-1.546 |
| | ø FIAT < | 0.254-0.508 | |
| 10-8  Crankshaft bearings - Main journals | A | 0.024-0.060 | 0.030-0.056 |
| | B | - | |
| | C | - | |
| 11  Thrust washers | S | 2.310-2.360 | 2.342-2.358 |
| | S FIAT > | 0.127 | |
| 11-8  Crankshaft end float | | 0.055-0.265 | 0.059-0.161 |

**Diagram showing connecting rod-piston assembly and positioning in the engine**

3. Area where number of cylinder liner/bore to which connecting rod belongs is stamped
4. Direction of rotation of engine
(The arrow shows the direction of rotation of the engine as seen from the timing side)

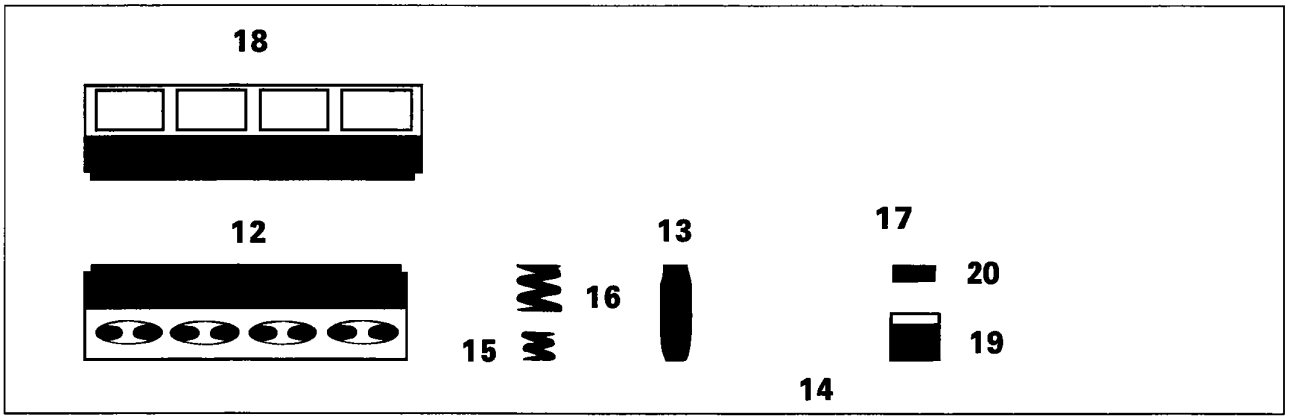
**Value (in mm) of offset between connecting rod axis and piston axis**

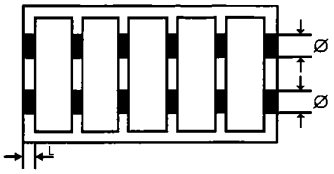
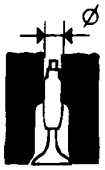
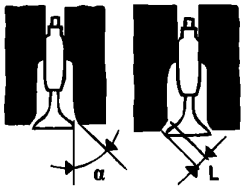
**D=0.85- 1.15 (for 1242 16v)**
**D=0.10- 0.60 (for 1998 20v)**





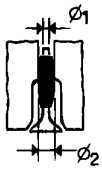
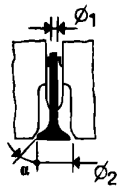
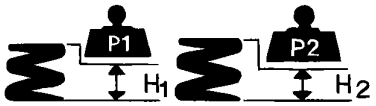
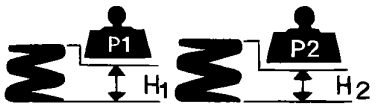

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| DESCRIPTION | | 1242 16v | 1998 20v |
|---|---|---|---|
| | | Values in mm | |
| Camshaft supports on cylinder head | Ø | - | 26.045-26.070 |
|  | L | - | 19.100-19.150 |
| 12  Valve guide bore In cylinder head | Ø | 9.959-9.989 | 12.950-12.977 |
|  Valve seat | α intake | 45°±20′ | 45°±5′ |
| | α exhaust | 45°±20′ | 45°±5′ |
| | L intake | 1.5 | about 2 |
| | L exhaust | | |
|  Volume of combustion chamber in cylinder head | $cm^3$ | 12.28 | 38.2 |



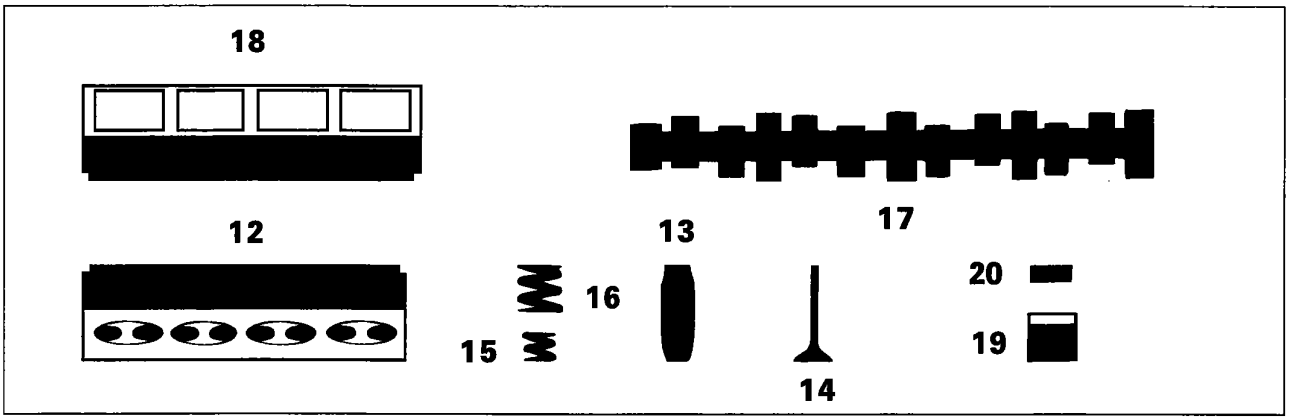

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| DESCRIPTION | | | 1242 16v | 1998 20v |
|---|---|---|---|---|
| | | | Values in mm | |
| 13  | Valve guide | ⌀ 1 | 6.022-6.040 | 7.022-7.040 |
| | | ⌀ 2 | 10.010-10.030 | 13.010-13.030 |
| | ⌀ 2 FIAT | > | - | 0.05-0.010-0.25 |
| 13-12  | Valve guide<br>Bore in cylinder head | | 0.049-0.051 | 0.033-0.080 |
| 12 | Tappet housing<br>In cylinder head | ⌀ | - | 33.000-33.025 |
| 14  | Valve | ⌀ 1 | 5.974-5.992 | 6.975-6.930 |
| | | ⌀ 2 | 22.250-22.250 | 29.900-30.200 |
| | | α | - | 45° 30′±5′ |
| | | ⌀ 1 | 5.974-5.992 | 6.960-6.975 |
| | | ⌀ 2 | 22.250-22.550 | 25.900-26.200 |
| | | α | - | 45° 30′±5′ |
| 14-13  | Valve<br>Valve guide | | 0.030-0.066 | 0.032-0.065<br>0.047-0.080 |
| 15  | Inner valve spring | P1 | - | 11.08-12.07daN |
| | | H1 | - | 29.5 |
| | | P2 | - | 21.58-23.54 daN |
| | | H2 | - | 20 |
| 16  | Outer valve spring | P1 | 22.5 daN | 27.7-29.43 daN |
| | | H1 | 31 | 34 |
| | | P2 | 42.3 | 48.46-52.38 daN |
| | | H2 | 23 | 24.5 |



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## 00.10



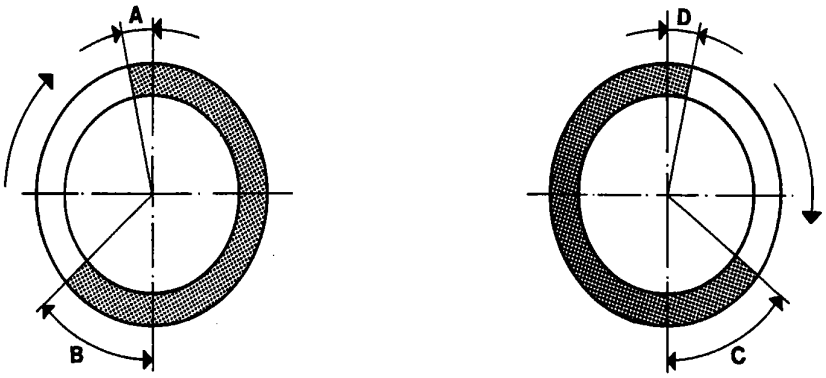

| DESCRIPTION | | 1242 16v | 1998 20v |
|---|---|---|---|
| | | Values in mm | |
| 17a / 17b Camshaft bearings | Ø1 | 35.000-35.015 | - |
| | Ø2 | 48.000-48.015 | - |
| | Ø3 | 49.000-49.015 | - |
| | Ø | - | 26.000-26.015 |
| | L | - | 19.250-19.330 |
| 17a Cam lift | | 7.5 | 9 |
| 17b Cam lift | | 7.5 | 9 |
| 12-17a / 12-17b Camshaft bearings Cylinder head supports | Ø1 | 0.030-0.070 | - |
| | Ø2 | 0.030-0.070 | |
| | Ø3 | 0.030-0.070 | |
| | radial | - | 0.030-0.070 |
| | axial | - | 0.100-0.230 |
| 18 Camhaft supports in camhaft housing | Ø1 | 35.045-35.070 | - |
| | Ø2 | 48.045-48.070 | - |
| | Ø3 | 49.045-49.070 | - |
| 18 Tappet housings | Ø | 28.400-28.421 | - |




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| DESCRIPTION | | 1242 16v | 1998 20v |
|---|---|---|---|
| | | Value in mm | |
| 19 Tappet | ⌀ | 28.354 - 28.370 | 32.959 - 32.975 |
| 19-12 Tappet Bore in cylinder head | | - | 0.025 - 0.066 |
| 19-18 Tappet - Housing in camshaft housing | | 0.046 - 0.051 | - |
| 17-20 clearance for timing check | | 0.45 | |
| operational clearance | | Hydraulic tappets | |

## TIMING DIAGRAMS



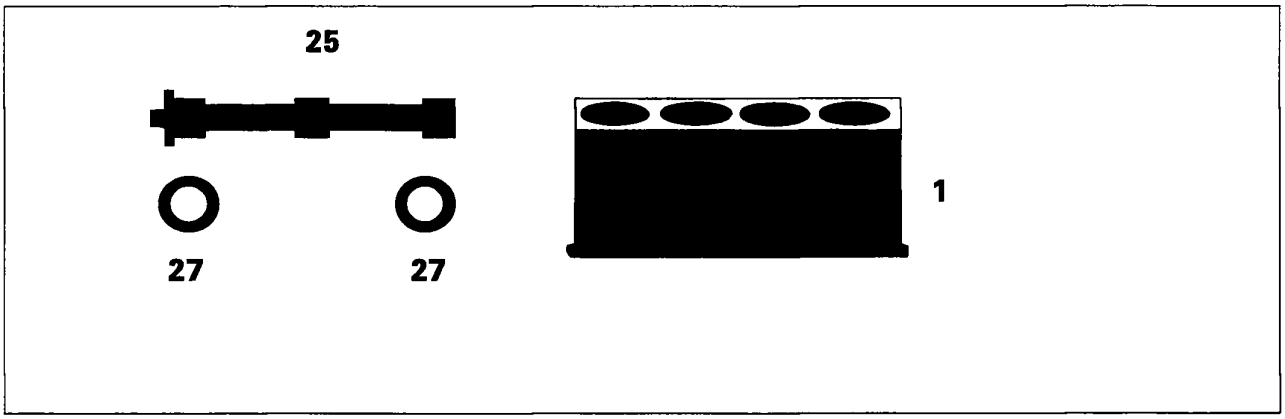

| | | | 1242 16v | 1998 20v |
|---|---|---|---|---|
| A — Inlet | | opens before T.D.C. | 0° | 9 (*) after T.D.C. |
| B — Inlet | | closes after B.D.C. | 32° 42′ | 49° (**) |
| C — Exhaust | | opens before B.D.C. | 32° 42′ | 40° |
| D — Exhaust | | closes after T.D.C. | 0° | 0° |

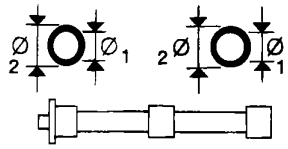
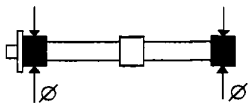
(*) With intervention of phase transformer opening 9° before TDC
(**) With intervention of phase transformer closing 31° after BDC



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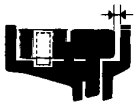
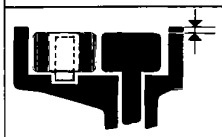
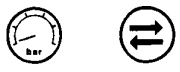
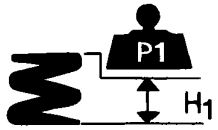
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| DESCRIPTION | | | 1242 16v | 1998 20v |
|---|---|---|---|---|
| | | | Values in mm | |
| **25** | Counter-balance shaft operation | | - | through oil pump driven gear |
| **27** |  Ball bearings for counter-balance shaft | Ø1 | - | 19.900 - 20.000 |
| | | Ø2 | - | 46.989 - 47.000 |
| **25** |  Counter-balance shaft bearings | Ø | - | 19.980 - 19.993 |
| **1** | Bearing seats in cylinder block/crankcase | Ø | - | 46.975 - 47.000 |
| **27-1** | Ball bearings / Crankcase seats | | - | + 0.011 - - 0.025 |
| **25-27** | Shaft bearings / Ball bearings | | - | + 0.020 - - 0.003 |




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| DESCRIPTION | | 1242 16v | 1998 20v |
|---|---|---|---|
| | | Values in mm | |
| Engine lubrication circuit | | forced circulation, via lobe geared pump with cartridge filter in series | forced circulation, via geared pump wih cartridge oil filter in series |
| Oil pump | | lobe gears | gears, located in crankshaft front cover |
| Pump operated | | through crankshaft | through chain driven by the crankshaft |
| Oil pressure relief valve | | incorporated in the crankshaft front cover | |
| Full flow filter | | - | cartridge |
| Insufficient oil pressure sender unit | | - | electrical |
|  | between pump casing and Driven gear | 0.100 – 0.210 | - |
|  | between edge of gears and pump casing | - | 0.110 – 0.180 |
|  | between edge of gears and pump cover | 0.025 – 0.070 | - |
|  | between upper edge of gears and pump cover | - | 0.16 – 0.086 |
| Full flow filter | | cartridge | |
| Insufficient oil pressure sender unit | | electrical | |
|  | between drive gear and driven gear | 0.30 | |
|  Operating pressure At a temperature of 100°C | when idling | 1 bar | |
| | at 4000 rpm | 4 bar | |
|   Oil pressure relief valve spring | $P_1$ | 11.73 – 12.51 | |
| | $H_1$ | 35 | |



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| COOLING SYSTEM | | | 1242 16v | 1998 20v |
|---|---|---|---|---|
| Cooling circuit | | | coolant circulation via centrifugal pump, radiator, expansion tank and fan operated by thermal switch | coolant circulation via centrifugal pump, radiator and two speed fan operated by engine control unit |
| Water pump operation | | | through belt | |
|  Thermal switch to engage fan | ⇄ | 1st stage | 90° ÷ 94°C | - |
| | | 2nd stage | 95° ÷ 99°C (■) | - |
| | stop | 1st stage | 85° ÷ 89°C | - |
| | | 2nd stage | 95° ÷ 94°C (■) | - |
| Operated by control unit to engage fan | ⇄ | 1st speed | - | 96° ÷ 97°C |
| | | 2nd speed | | 101 ÷ 102° |
| | stop | 1st speed | - | 93° ÷ 94°C |
| | | 2nd speed | | 98° ÷ 99°C |
| Engine coolant thermostat | | opening | 81° - 85°C | |
| | | max opening | 103°C | 101°C-105°C |
| | | valve travel | ≥ 9.5 mm | |
| Fitting clearance between impeller vanes and pump casing | | | 0.4 ÷ 0.9 mm | 0.4 ÷ 0.95 mm |
| Pressure for checking system water tightness | | | 0.98 bar | |
| Pressure for checking exhaust valve on expansion tank cap | | | 0.98 bar | |

(■) Versions with climate control

| Checking idle concentration of pollutant emissions | CO (%) | HC (p.p.m.) | $CO_2$ (%) |
|---|---|---|---|
| Upstream of the catalytic converter | 0.4 – 1 | ⩽ 600 | ⩾ 12 |
| Downstream of the catalytic converter | ⩽ 0,35 | ⩽ 90 | ⩾ 13 |




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| FUEL SYSTEM | 1242 16v | 1998 20v |
|---|---|---|
| Type | BOSCH 1.5.5 MPI electronic integrated injection/ignition | BOSCH Motronic MPI electronic integrated injection/ignition |
| Pump | electric immersed in the tank | |
| Flow rate | ≥ 110 l/h | ≥ 120 l/h |
| Fuel pressure regulator setting | 3 bar | |

**INTEGRATED ELECTRONIC INJECTION/IGNITION SYSTEM COMPONENTS**

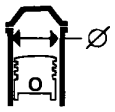
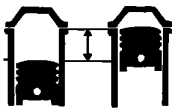
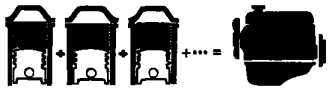
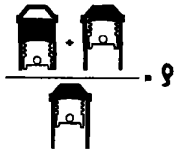
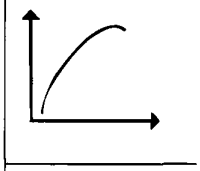
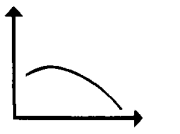
| | | |
|---|---|---|
| Injection/ignition system electronic control unit | Bosch 0.261.204.578 | Bosch 0.261.204.271 |
| Butterfly casing | Bosch 0.280.750.013 | - |
| Motorized butterfly casing | - | Bosch 0.250.003.052 |
| Absolute pressure sensor | Bosch 0.261.230.013 | - |
| Injector | Bosch 0.280.155.816 | Bosch 0.280.155.770 |
| Electric fuel pump | Bosch 0.580.313.011 | |
| Air flow meter | - | Bosch 0.281.002.199 |
| Engine coolant temperature sensor | ELTH 2690350 – SYLEA 402.183.01 | |
| Lambda sensor | Bosch 0.258.006.071 | Bosch 0.258.006.072 |
| Fuel vapour solenoid valve | Bosch 0.280.142.330 | Bosch 0.280.142.340 |
| Detonation sensor | Bosch 0.261.231.007 | Bosch 0.261.231.131 |
| Hall effect injection timing sensor | - | Bosch 0.232.101.036 |
| Top Dead Centre and rpm sensor | Bosch 0.281.210.124 | Bosch 0.261.210.160 |

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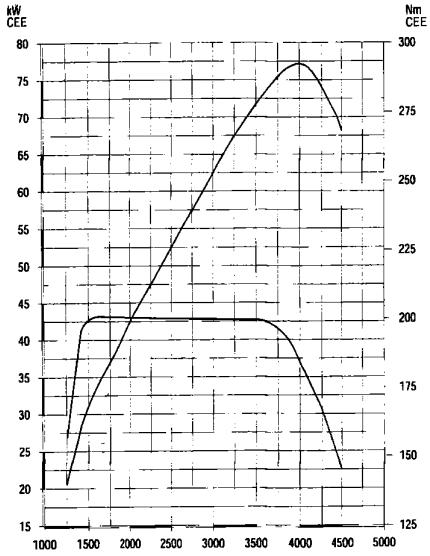
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**SPECIFICATIONS**

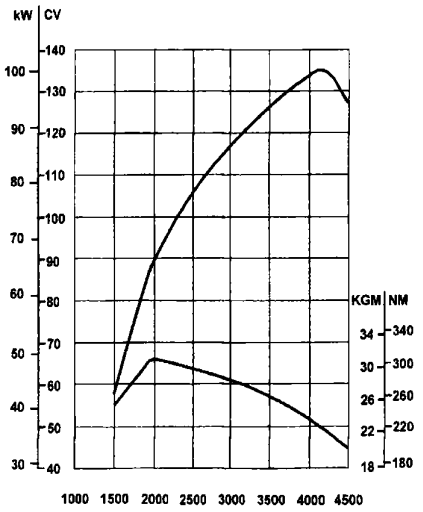
| | | | 1910 JTD | 2387 JTD |
|---|---|---|---|---|
|  | Cycle | | Diesel 4 stroke | |
| | Timing | | SOHC | |
| | Engine balancing | | - | through 1 counter-balance shaft |
| | Type of fuel system | | Direct injection Turbocharger + intercooler | |
|  | Number of cylinders | | 4 in line | 5 in line |
|  | Cylinder liner (bore) | mm | 82 | |
|  | Stroke | mm | 90.4 | |
|  | Capacity | $cm^2$ | 1910 | 2387 |
|  | Compression ratio | | 18.45 ± 0.5 | 18.6 ± 0.5 |
|  | Max power | KW (CEE) (CV) (CEE) | 77 (105) | 100 (136) |
| | | rpm | 4000 | 4200 |
|  | Max torque | daNm (CEE) (kgm) (CEE) | 20 (20.4) | 31 (31) |
| | | rpm | 1500 | 2000 |




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1910 JTD




2387 JTD

### Test bench cycles for overhauled engines

During the bench test for overhauled engines, it is not advisable to let the engine reach maximum speed, but to stick to the figures recommended in the table; complete the running in of the actual engine in the vehicle.

| Test speed rpm | Time in minutes | Load on the brakes |
|---|---|---|
| 800 ÷ 1000<br>1500<br>2000 | 10'<br>10'<br>10' | no load<br>no load<br>no load |

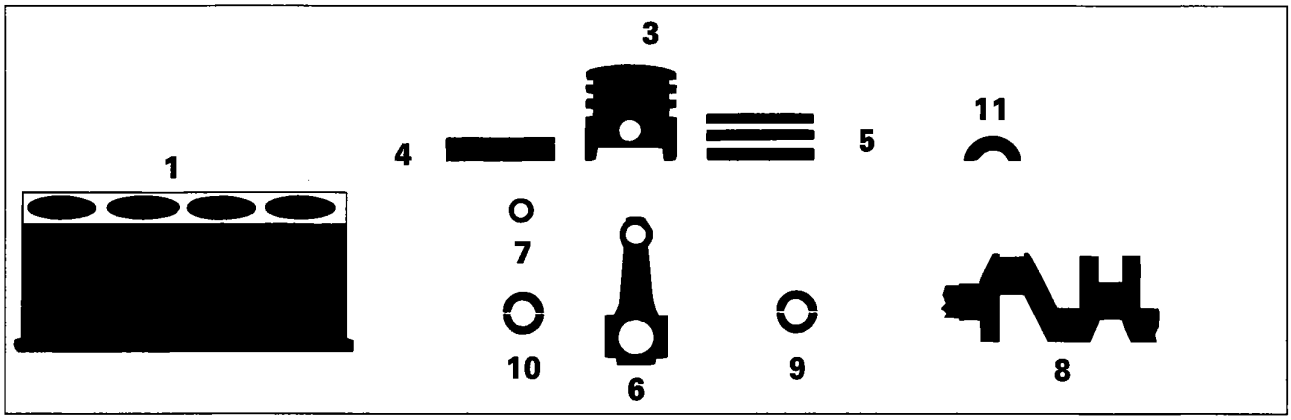
### Typical engine curves obtained using the CEE method

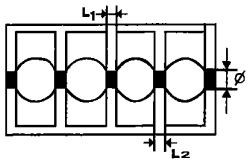
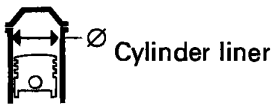
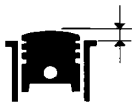
The power curves illustrated can be obtained with the engine overhauled and run in, without a fan, with a silencer and air filter fitted, at sea level.



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## 00.10




| DESCRIPTION | | | 1910 JTD | 2387 JTD |
|---|---|---|---|---|
| | | | Values in mm | |
| 1 Main bearing supports |  | L | 21.750 - 22.250 | 21.720 - 21.800 |
| | | L1 | 22.300 - 22.700 | - |
| | | L2 | 21.750 - 22.250 | - |
| | | ø | 63.691 - 63.732 | |
| |  Cylinder liner ø | A | 82.000 - 82.010 | |
| | | B | 82.010 - 82.020 | |
| | | C | 82.020 - 82.030 | |
| 3 Piston |  ø | X | 8 | 10 |
| | | A | 81.920 - 81.930 | 81.930 - 81.940 |
| | | B | 81.930 - 81.940 | 81.940 - 81.950 |
| | | C | 81.940 - 81.950 | 81.950 - 81.960 |
| | ø FIAT > | | 0.4 | |
| 3-1 |  Piston projection | | 0.845 - 1.105 | 0.637 - 1,162 |
| 3 |  Difference in weight between pistons | | ± 5 g | |
| 3-1 |  Piston Cylinder liner | | 0.070-0.090 | 0.060 - 0.080 |




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| DESCRIPTION | | 1910 JTD | 2387 JTD |
|---|---|---|---|
| | | Values in mm | |
| **3** Gudgeon pin housing | Ø | 25.999 - 26.004 | 25.991 - 25.996 |
| **3** Piston ring grooves | 1 | 2.685 - 2.715 (*) | 2.675 - 2.705 (1) |
| | 2 | 2.020 - 2.040 | 2.010 - 2.030 |
| | 3 | 3.020 - 3.040 | |
| **4** | Ø | 25.982 - 25.988 | |
| Gudgeon pin Ø FIAT > | | - | |
| **4-3** Gudgeon pin - Housing | | 0.011 - 0.022 | 0.003 - 0.014 |
| **5** Piston rings L | 1 | 2.568 - 2.597 (**) | 2.575 - 2.595 |
| | 2 | 1.970 - 1.995 | 1.970 - 1.990 |
| | 3 | 2.970 - 2.990 | 2.975 - 2.990 |
| Ø FIAT > | | 0.4 - 0.6 | 0.4 |
| **5-3** Piston rings Piston ring grooves | 1 | 0.088 - 0.147 | - |
| | 2 | 0.025 - 0.070 | 0.020 - 0.060 |
| | 3 | 0.030 - 0.070 | 0.030 - 0.065 |
| **5-1** Opening at end of piston rings in cylinder liner | 1 | 0.250 - 0.400 | |
| | 2 | 0.250 - 0.500 | |
| | 3 | 0.250 - 0.500 | |

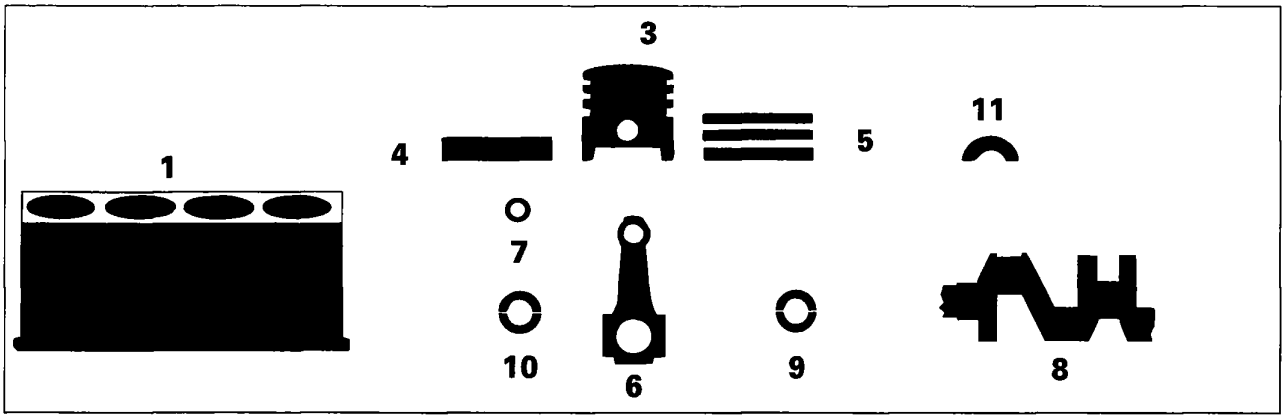
(*) Measured on the 73.8 mm diameter
(1) Measured on the 79 mm diameter

(**) Measured 1.5 mm from the outside edge



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## 00.10




| DESCRIPTION | | | 1910 JTD | 2387 JTD |
|---|---|---|---|---|
| | | | Values in mm | |
| 6 | Small end bush or pin housing | Ø1 | 28.939 - 28.972 | |
| 6 | Big end bearing housing | Ø2 | 53.897 - 53.909 | 53.883 - 53.923 |
| 6 | Difference in weight between connecting rods | | ± 2,5 g | |
| 7 | Small end bush | Ø1 | 29.018 - 29.038 | |
| 7 | Small end bush | Ø 2 | 26.006 - 26.012 | |
| 4-7 | Gudgeon pin Small end bush | | 0.018 - 0.030 | |
| 7-6 | Small end bush Bush housing | | 0.046 - 0.099 | |
| 8 | Main joumals | Ø1 — 1 | 59.994 - 60.000 | |
| | | Ø1 — 2 | 59.988 - 59.994 | |
| | | Ø1 — 3 | 59.982 - 59.988 | |
| | Crank pins | Ø2 — A | 50.799 - 50.805 | |
| | | Ø2 — B | 50.793 - 50.799 | |
| | | Ø2 — C | 50.787 - 50.793 | |
| | | L | 26.80 - 27.20 | 26.575 - 26.625 |
| | | L1 | 25.90 - 26.10 | - |

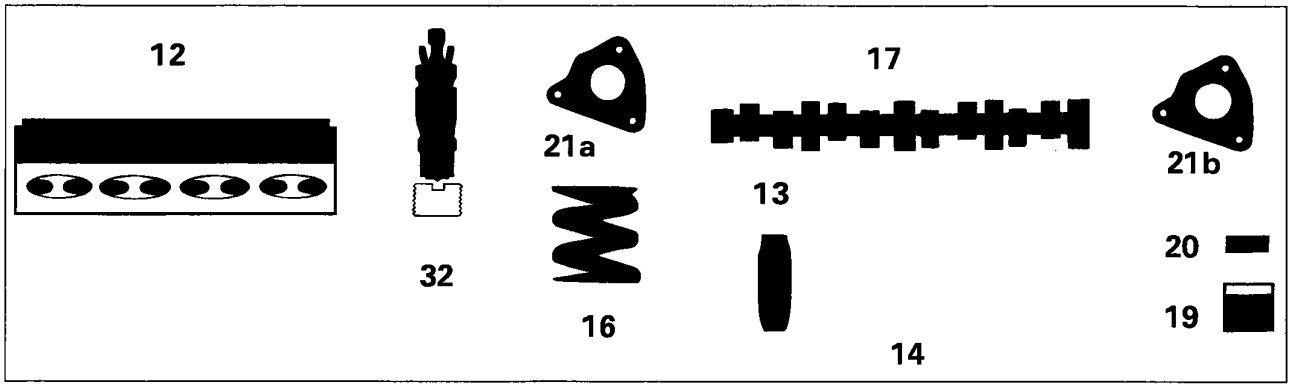


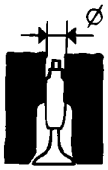
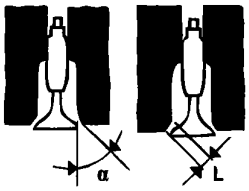
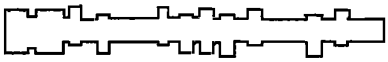
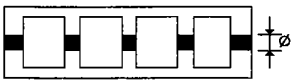
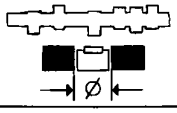

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| DESCRIPTION | | 1910 JTD | 2387 JTD |
|---|---|---|---|
| | | Values in mm | |
| **9** Crankshaft bearings | L 1 | 1.836 - 1.840 | |
| | L 2 | 1.839 - 1.843 | |
| | L 3 | 1.842 - 1.846 | |
| | Ø FIAT < | 0.254 – 0.508 | |
| **9-8** Crankshaft bearings - Main journals | | 0.011 - 0.071 | 0.025 - 0.052 |
| **10** Big end bearings | L A | 1.527 - 1.531 | |
| | L B | 1.530 - 1.534 | |
| | L C | 1.533 - 1.537 | |
| | Ø FIAT < | 0.254 – 0.508 | |
| **10-8** Big end bearings - Main journals | | 0.030 - 0.056 | 0.016 - 0.070 |
| **11** Thrust washers | S | 2.469 - 2.485 | 2.342 - 2.358 |
| | S FIAT > | 0.127 | |
| **11-8** Crankshaft end float | | 0.049 - 0.211 | 0.059 - 0.221 |



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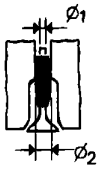
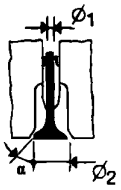
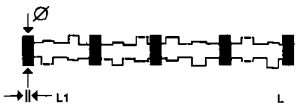



| DESCRIPTION | | | 1910 JTD | 2387 JTD |
|---|---|---|---|---|
| | | | Values in mm | |
|  Valve guide bore in cylinder head | Ø | | 13.950 - 13.977 | |
|  | α |  | 45°±20′ | 45°±5′ |
| | |  | 45°±20′ | 45°±5′ |
| | L | | About 2.7 | |
| 12 Valve seat | | | | |
|  | Ø | | 26.045 - 26.070 | |
|  | L* | | 19.100 - 19.150 | |
| L = Camshaft supports | | | | |
|  Tappet housing | Ø | | 37.000 - 37.025 | |

(*) Cap measurement

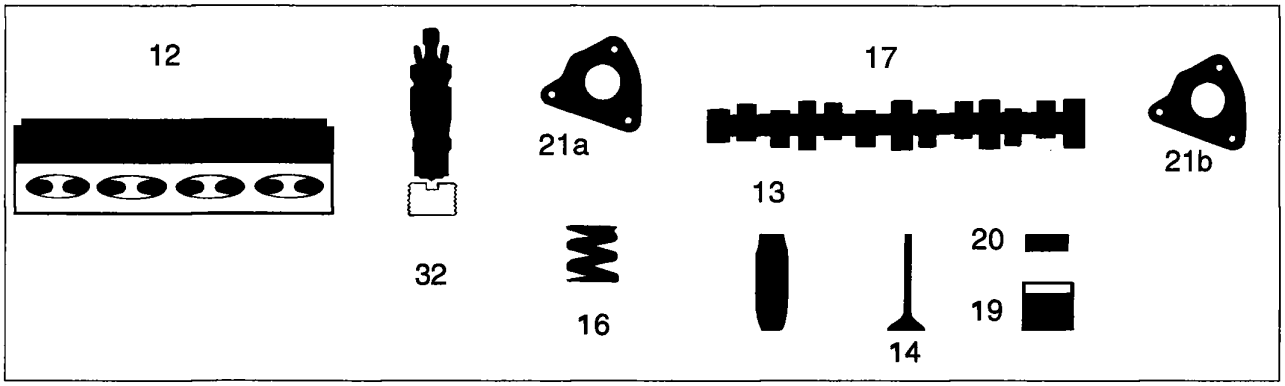



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| DESCRIPTION | | | 1910 JTD | 2387 JTD |
|---|---|---|---|---|
| | | | Values in mm | |
| 13  | Valve guide | $\varnothing_1$ | 8.022 - 8.040 | |
| | | $\varnothing_2$ | 14.010 - 14.030 | |
| | | $\varnothing_2$ FIAT > | 0.05 – 0.10 – 0.25 | |
| 13-12  | Valve guide<br>Bore in cylinder head | | 0.033 - 0.080 | |
| 14  | Valve | $\varnothing_1$ | 7.974 - 7.992 | |
| | | $\varnothing_2$ | 35.40 - 35.60 | 37.40 - 37.70 |
| | | $\alpha$ | 45° 30′ ± 15′ | 45° 30′ ± 5′ |
| | | $\varnothing_1$ | 7.974 - 7.992 | |
| | | $\varnothing_2$ | 34.40 - 34.60 | 30.90 - 31.20 |
| | | $\alpha$ | 45° 30′ ± 5′ | |
| 14-13 | Valve - Valve guid | | 0.030 - 0.066 | |
| 16  | Valve spring | $P_1$ | 36.69 - 39.63 daN | 36.7 - 36.9 daN |
| | | $H_1$ | 36 | |
| | | $P_2$ | 55.91 - 60.82 daN | 56 - 61 daN |
| | | $H_2$ | 26.5 | |
| 17  | | $\varnothing$ | 26.000 - 26.015 | |
| | | L | 23.10 - 23.70 | - |
| | | $L_1$ | 19.25 - 19.30 | 19.25 - 19.33 |



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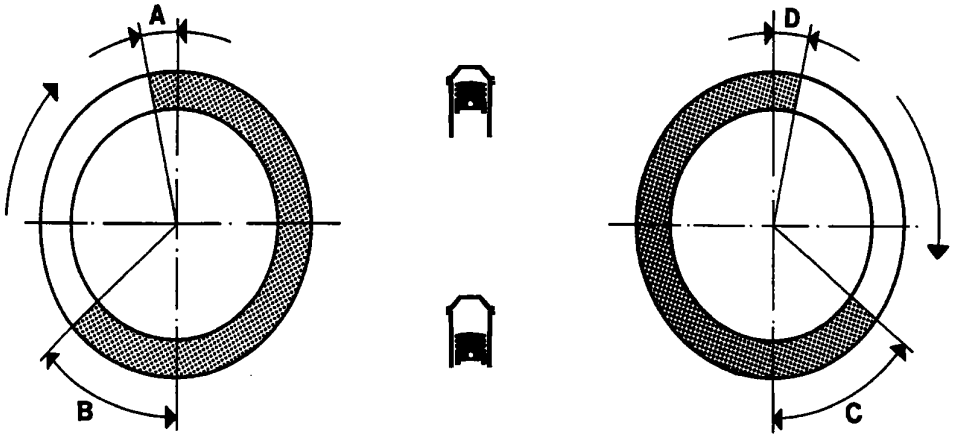



| DESCRIPTION | | | 1910 JTD | 2387 JTD |
|---|---|---|---|---|
| | | | Values in mm | |
| 17-12 | | radial | 0.030 - 0.070 | |
| | | axial | 0.100 - 0.230 | |
| 17 | Cam lift | | 8.5 | |
| | | | 8.5 | |
| 19 | Tappets | Ø | 36.975 - 36.995 | |
| 19-12 | Tappet - Cylinder head | | 0.005 - 0.050 | |
| 20 | Shim S | 0.05 | 3.25 - 4.90 | 3.25 - 4.70 |
| 17-20 | clearance for timing check | | 0.50 | |
| | | | 0.50 | |
| | | | 0.30 ± 0.05 | |
| | operational clearance | | 0.35 ± 0.05 | |




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## TIMING DIAGRAMS

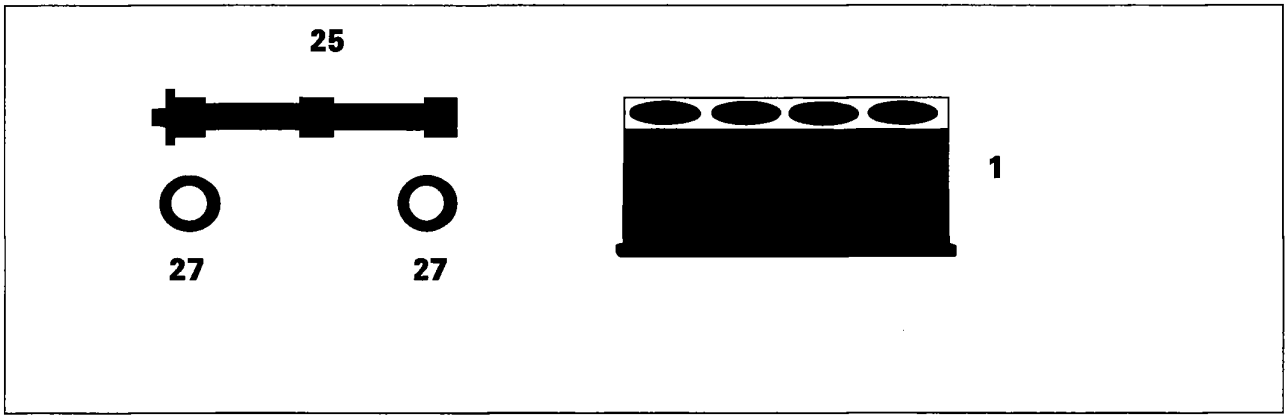


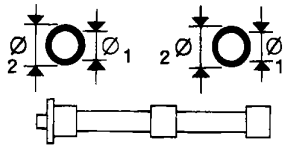
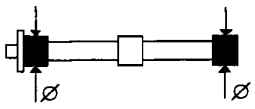

## TIMING ANGLES

| | | 1910 JTD | 2387 JTD |
|---|---|---|---|
| A — Inlet | opens after TDC | 0° | 6° |
| B — Inlet | closes after BDC | 32° | 26° |
| C — Exhaust | opens after BDC | 32° | 26° |
| D — Exhaust | closes after TDC | 0° | 6° |



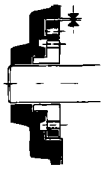
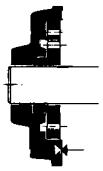
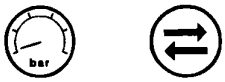
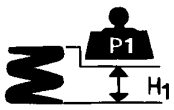
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| DESCRIPTION | | | 2387 JTD |
|---|---|---|---|
| | | | Values in mm |
| 25 | Counter-balance shafts | | n° 1 |
| | Shaft operation | | through oil pump driven gear |
| 27 |  Ball bearings for counter-balance shaft | $\varnothing_1$ | 19.900 - 20.000 |
| | | $\varnothing_2$ | 46.989 - 47.00 |
| 25 |  Counter-balance shaft bearings | $\varnothing$ | 19.980 - 19.993 |
| 1 | Bearing seats in cylinder block/crankcase | $\varnothing$ | 46.975 - 47.000 |
| 27-1 | Ball bearings / Crankcase seats | | +0.011 - -0.025 |
| 25-27 | Shaft bearings / Ball bearings | | +0.020 - -0.003 |

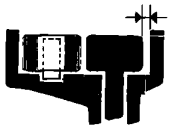
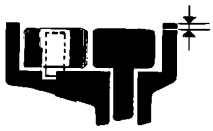
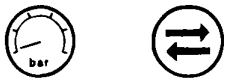
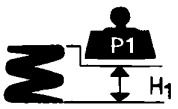



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| | | 1910 JTD |
|---|---|---|
| **LUBRICATION** | | Values in mm |
| Engine lubrication circuit | | forced circulation, via lobe geared pump with cartridge filter in series |
| Oil pump | | lobe gears |
| Pump operated | | through crankshaft |
| Oil pressure relief valve | | incorported in crankshaft front cover |
|  | between pump casing housing and driven gear | 0.080 - 0.186 |
|  | between upper side of gears and pump cover | 0.025 - 0.056 |
| Full flow filter | | cartridge |
| Insufficient oil pressure sender unit | | electrical |
|  Operating pressure at a temperature of 100°C | | 3.43 - 4.9 bar |
|  Oil pressure relief valve spring | $P_1$ | 6.27 - 7.06 daN |
| | $H_1$ | 36 |



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| | | 2387 JTD |
|---|---|---|
| **LUBRICATION** | | Values in mm |
| Engine lubrication circuit | | forced circulation, via geared pump with cartridge filter in series |
| Oil pump | | geared, located in the crankshaft front cover |
| Pump operated | | by chain driven by crankshaft |
| Oil pressure relief valve | | incorporated in the crankshaft front cover |
|  | between edge of gears and pump casing | 0.110 - 0.180 |
|  | between upper edge of gears and pump casing | 0.016 - 0.086 |
| Full flow filter | | cartridge |
| Insufficient oil pressure sender unit | | electrical |
|  | between drive gear and driven gear | 0.30 |
|  Operating pressure at a temperature of 100°C | | 5 - 5.5 bar |
|  Oil pressure relief valve spring | $P_1$ | 11.73 - 12.51 daN |
| | $H_1$ | 35 |




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| COOLING SYSTEM | | | 1910 JTD | 2387 JTD |
|---|---|---|---|---|
| Cooling circuit | | | coolant circulation via centrifugal pump, radiator and two speed fan operated by engine control unit | |
| Water pump operated | | | by belt | |
| Operated by control unit to engage fan | ⇄ | 1st speed | 96° - 97°C | |
| | | 2nd speed | 101° - 102°C | |
| | stop | 1st speed | 93° - 94°C | |
| | | 2nd speed | 98° - 99°C | |
| Engine coolant thermostat | | opening | 88° | |
| | | max opening | 103° | |
| | | valve travel | ⩾ 9.5 mm | |
| Fitting clearance between impeller vanes and pump casing | | | 0.40 - 0.75 mm | |
| Pressure for checking radiator water tightness | | | 1 ± 0,1 bar | |
| Pressure for checking calibration of exhaust spring on expansion tank | | | 1 ± 0.1 bar | |

| FUEL SYSTEM | |
|---|---|
| Firing order | 1 – 2 – 4 – 5 - 3 |
| Rotary piston injection pump | RADIALJET |
| Nozzle | - |
| Injector setting pressure | ⩽ 1300 bar |

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| BOSCH COMMON RAIL ELECTRONIC FUEL SYSTEM COMPONENTS | 1910 JTD |
|---|---|
| Control unit | Bosch 0.281.001.928 |
| Flow meter | Bosch 0.281.002.199 |
| Engine coolant temperature sensor | Jaeger 402.183.01 |
| Diesel temperature sensor | Bosch 0.281.002.209 |
| Rpm sensor | Bosch 0.281.002.214 |
| Timing sensor | Bosch 0.281.002.213 |
| Turbochrager pressure sensor | Bosch 0.281.002.215 |
| Fuel pressure sensor | Bosch 0.281.002.210 |
| Injector | Bosch 0.445.110.002 |
| Pre-heating control unit | Bosch 0.281.003.215 |
| Heater plugs | Bosch 0.250.202.028 |
| E.G.R. solenoid valve | 46419651 |




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| INJECTION SYSTEM COMPONENTS | 2387 JTD |
|---|---|
| | Values in mm |
| Injection system electronic control unit | 0.281.001.935 |
| Supercharging pressure sender unit | 0.281.002.215 |
| Fuel temperature sensor | 0.281.002.209\ |
| Electric fuel pump | 0.580.464.984 |
| Air flow meter | 0.280.218.019 |
| Fuel pressure sensor | 0.281.002.210 |
| Engine coolant temperature sensor | 0.281.002.209 |
| Timing sensor | 0.281.002.213 |
| Top Dead Centre and rpm sensor | 0.281.002.214 |
| Potentiometer on accelerator pedal | 0.281.002.202 |
| Pressure regulator (DVR) | - |
| E.G.R. solenoid valve | Borg Warner - Bitron |

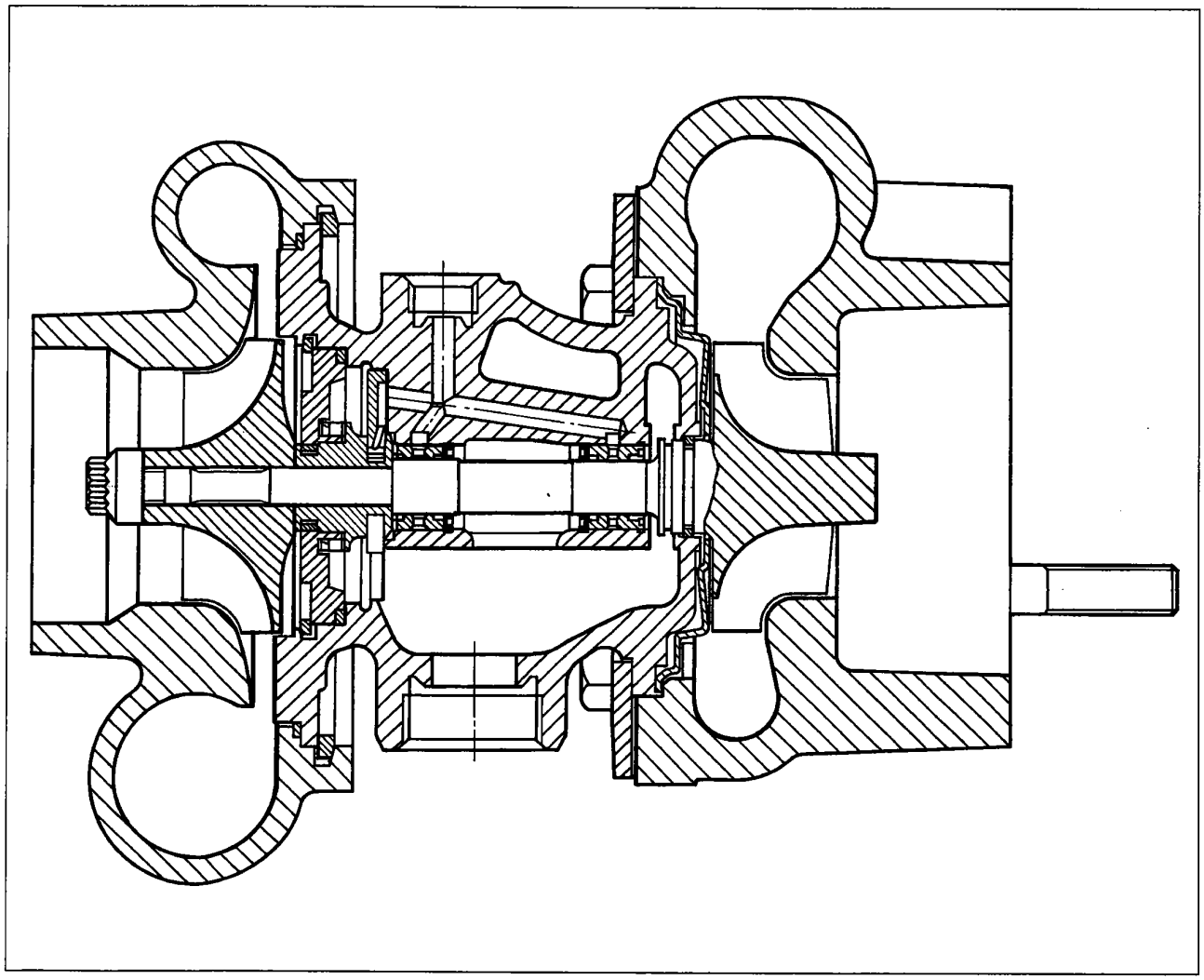
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## 00.10

**SUPERCHARGING** Turbocharger operated by exhaust gases with waste-gate pressure valve and air/air heat exchanger (intercooler)

| COOLING SYSTEM | 1910 JTD | 2387 JTD |
|---|---|---|
| Turbocharger: type | Garret GT 15 | IHI VL6 variable geometry |
| Maximum supercharging pressure | 1.05 bar | |

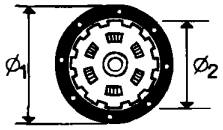
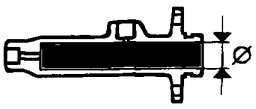
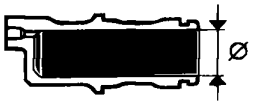


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**CROSS SECTION OF TURBOCHARGER**




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| | | 1242 16v | 1998 20v | 1910 JTD | 2387 JTD |
|---|---|---|---|---|---|
| | | Values in mm | | | |
| Type | |   dry, single plate with bearing | | | |
|  Operating mechanism | |  Spring | | | |
| Spring loading | daN | 430 | 600 | 485 | 600 |
|  Driven disc | $Ø_1$ | 200 | 230 | 215 | 235 |
| | $Ø_2$ | 137 | 155 | 147 | 165 |
|  Distance between pedal in end of travel position and pedal in rest position | | 163 | | 136 | |
| Clutch operation | | mechanical | | hydraulic | |
|  Clutch operating pump | Ø | - | | 16.05 (3/4") | |
|  Operating cylinder | Ø | - | | 25.4 (1") | |



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| | | 1242 16v | 1998 20v |
|---|---|---|---|
| | | 1 3 5 / 2 4 R | |
| | Type | C. 514.5.13 | C.510.5.21 |
| **GEARBOX** | | | |
| Synchronizers | spring ring (Porsche type) | | - |
| | baulk ring type | | 1 3 5 / 2 4 |
| Gears | straight toothed | | R |
| | helical toothed | | 1 3 5 / 2 4 |
| Gear ratios | 1 | 3.909 | 3.545 |
| | 2 | 2.158 | 2.238 |
| | 3 | 1.480 | 1.520 |
| | 4 | 1.121 | 1.156 |
| | 5 | 0.897 | 0.919 |
| | R | 4.071 | 3.909 |




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| DIFFERENTIAL | | 1242 16v | 1998 20v |
|---|---|---|---|
| Ratio crown wheel and pinion reduction | | 4.071 (14.57) | 3.733 (15/56) |
| Ratio at the wheels | 1 | 15.914 | 13.233 |
| | 2 | 8.786 | 8.354 |
| | 3 | 6.025 | 5.674 |
| | 4 | 4.564 | 4.315 |
| | 5 | 3.652 | 3.431 |
| | R | 16.573 | 14.593 |
| Differential internal housing bearing | | conical roller bearings | |
| Adjustment of bearing pre-loading | | by shims | |
| Thickness of shims | 0.05 mm | - | 1.70 -2.60 |
| | 0.10 mm | 2.00 - 3.00 | - |
| Recommended interference for exact bearing pre-loading | mm | bearings not loaded = 0.12<br>bearings loaded (350daN) = 0.08 | |
| Clearance between planet/satellite gears | mm | ≤ 0.10 | |
| Adjustment of clearance between planet/satellite gears | | no adjustment is carried out | by shims: no adjustment is carried out |
| Thickness of shims | (0.05) mm | - | 0.80 - 1.25 / - |



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## 00.21.27

| | | 1910 JTD | 2387 JTD |
|---|---|---|---|
| | | 1 3 5 / 2 4 R | |
| GEARBOX | Type | C. 510.5.21 | C.530.5.31.01 |
| Synchronizers | spring ring (Porsche type) | - | |
| | baulk ring type | 1 3 5 / 2 4 | 1 3 5 / 2 4 R |
| Gears | straight toothed | R | |
| | helical toothed | 1 3 5 / 2 4 | |
| Gear ratios | 1 | 3.909 | 3.800 |
| | 2 | 2.238 | 2.235 |
| | 3 | 1.444 | 1.360 |
| | 4 | 1.029 | 0.971 |
| | 5 | 0.767 | 0.707 |
| | R | 3.909 | 3.545 |
| | Ratio crown wheel and pinion reduction | 3.150 (20/63) | 3.353 (17/57) |




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| DIFFERENTIAL | | 1910 JTD | 2387 JTD |
|---|---|---|---|
| Ratio at the wheels | 1 | 12.568 | 12.741 |
| | 2 | 7.049 | 7.494 |
| | 3 | 4.549 | 4.560 |
| | 4 | 3.241 | 3.256 |
| | 5 | 2.416 | 2.370 |
| | R | 12.313 | 11.887 |
| Differential internal housing bearing | | conical roller bearings | |
| Adjustment of bearing pre-loading | | by shims | |
| Thickness of shims | mm 0.05 | 1.70 - 2.60 | 1.25 - 1.60 |
| Bearing rolling torque | | - | 0.10 - 0.14 |
| Recommended interference for exact bearing pre-loading | mm | Bearings not loaded = 0.12<br>bearings loaded (350 daN) = 0.08 | - |
| Clearance between planet/satellite gears | mm | ≤ 0.10 | 0.10 - 0.20 |
| Adjustment of clearance between planet/satellite gears | | no adjustment | by shims |
| Thickness of shims | (0.05) mm | - | 1.8 - 2.2 |

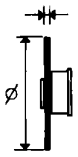
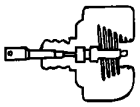
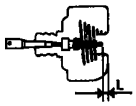
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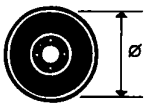
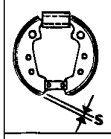
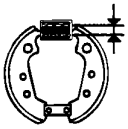
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## 00.33

### FRONT BRAKES

| | | | 1242 16v | 1910 JTD | 1242 16v ● | 1910 JTD ● |
|---|---|---|---|---|---|---|
|  | Disc | Ø | 257 | | | |
| | | S (new) | 11.80-12.10 | 19.80 - 20.10 | | |
| | | S (worn) | 11.10 | 18.55 | | |
| | | S < allowed | 10.20 | 18.20 | | |
|  | Brake pads | S < allowed | 1.5 | | | |
|  | Caliper | Ø | 54 | | | |
|  | Master cylinder (pump) | Ø | 22.225 (7/8") | | | |
|  | Brake servo | | Iso-Vac 8» pneumatic vacuum acting on all four wheels | | | |
|  | Distance of hydraulic piston push rod from master cylinder support plate | L | 22.45 - 22.65 | | | |

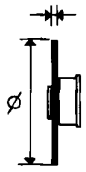
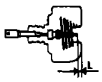
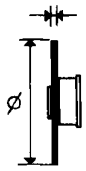
### REAR BRAKES

| | | | | | |
|---|---|---|---|---|---|
|  | Drum | Ø | 203.10 - 203.40 | 228.30-228.60 | |
| | | Ø (new) | 204.10 | 229.30 | |
| | | Ø > allowed | 204.70 | 230.00 | |
|  | Shoes | S < allowed | 1.5 | | |
|  | Cylinders | Ø | 22.00 | | |
|  | Reduction ratio | Pressure regulators | 0.36 | - | |
| | | Load proportioning valves | - | 0.36 | |

(●) Weekend Version




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| | 1998 16v | 2387 JTD |
|---|---|---|
| **FRONT BRAKES** | Values in mm | |
|  Disc — Ø | 283.800 - 284.200 | |
| | 21.800 - 22.100 | |
| | 20.55 | |
| S < allowed | 20.20 | |
|  Brake pads — S < allowed | 1.5 | |
|  Caliper — Ø | 54 | |
|  Master cylinder (pump) — Ø | 23.81 (15/16") | |
|  Brake servo | Iso-Vac 8" + 7" pneumatic vacuum acting on all four wheels | |
|  Distance of hydraulic piston push rod from master cylinder support plate — L | 22.45 - 22.65 | |
| **REAR BRAKES** | | |
|  Disc — Ø | 240 | |
| S | 10.80 ÷ 11.10 | |
| S | 10.10 | |
| S < allowed | 9.20 | |
|  Brake pads — S < allowed | 1.5 | |
|  Caliper — Ø | 34 | |
|  Load proportioning valve | acting on rear wheels | |
| Ratio (reduction) | 0.36 | |



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| | ENGINE TYPE | 1242 16v / 1910 JTD | 1998 20v | 2387 TD |
|---|---|---|---|---|
| Type | | Rack and pinion power assisted | | |
| Ratio | no. of turns lock to lock | 3 | 2.9 | 2.8 |
| | rack travel | 142±1.5 mm | 137±1.5 mm | 132±1.5 mm |
| Turning circle (Ø) | | 10.7 | 11 | 11.4 |
| Steering angle | outer wheel α1 | 31° ± 30′ | | |
| | inner wheel α2 | 38° ± 30′ | | |
| Steering column | | with 2 universal joints | | |




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| ENGINE TYPE | Wheel rim | | Tyre Tubeless radial, type | Inflation pressure in bar | | | |
|---|---|---|---|---|---|---|---|
| | | | | Front | | Rear | |
| | pressed steel | light alloy | | average load | heavy load | average load | heavy load |
| 1242 16v | 5½J×14»-37 | 6J×15»-43 | 175/70 R14 84T<br>195/55 R15 84V | 2.1 bar | 2.2 bar | 2.3 bar | 2.5 bar |
| 1998 20v | - | 6J×15»-43 | 195/60 R15 88V | 2.3 bar | 2.5 bar | 2.3 bar | 2.5 bar |
| 1910 JTD | 5½J×14»-37<br>5½J×14»-43 | 6J×15»-43 | 175/70 R14 84H (■)<br>185/65 R14 86H (■)(▲)<br>195/55 R15 84V | 2.1 bar | 2.2 bar | 2.3 bar | 2.5 bar |
| 2387 JTD | - | 5½J×15»-43 | 195/60 R15 88V | 2.4 bar | 2.5 bar | 2.3 bar | 2.5 bar |
| SPARE WHEEL (*) | 4B×15"-43.3 | 4B×15»-35 | 185/65 R14 86H (▲)<br>125/80 R5 95m | 4.2 bar | | | |

The tyre inflation pressure for the Marea Weekend with a commercial load (1 person + 500 kg) is 2.3 bar for the front wheels for all versions excluding the 1998 20V and 2387 JTD versions for which it is 2.5, whilst the rear tyre inflation pressure is 3 bar for all versions.

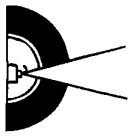
(*) Speed limit: 80 km/h
(■) Special tyres for the Marea version
(■) Special tyres for the Marea Weekend version
(▲) For the TAXI version

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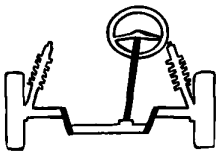
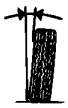
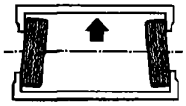
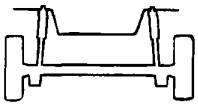
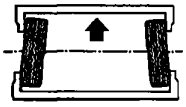
## 00.44

### WHEEL GEOMETRY





unladen vehicle (■)

| | | |
|---|---|---|
|  front suspension | camber (**)  | - 38′ 10» ± 30′ |
| | caster (**)  | 2° 51′ ± 30′ |
| | toe in  | -1 - 1 mm |
| | offset front wheel ▲ | 0° |
|  rear suspension | camber (**)  | 0° 52′ 00» ± 30′ |
| | toe in (**)  | 0.85 ± 2 mm |
| | thrust angle rear wheels ▲ | 0° |

(**) Angles cannot be adjusted
(■) With the tyres inflated to the correct pressure and the vehicle in running order with 5 litres of fuel
(▲) Angular values, which cannot be adjusted, used for the correct alignment of the vehicle




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Front suspension independent, Mac Pherson type with transverse lower track control arms secured to an auxiliary crossmember. Offset coil springs and double acting, telescopic, hydraulic shock absorbers. Anti-roll bar connected to the telescopic damper.

| ENGINE TYPE | | 1242 16v | 1998 20v |
|---|---|---|---|
| **Shock absorbers** | | | |
| Type | | Double acting, telescopic, hydraulic | |
| Open (start of damping action) | mm | 508 ± 2.5 | 501 ± 2.5 |
| Closed (metal against metal) | mm | 361 ± 2.5 | 354 ± 2.5 |
| Travel | mm | 147 | |
| **Anti-roll bar** | | | |
| Diameter of anti-roll bar | mm | 18 | |

| | | 1910 JTD | 2387 JTD |
|---|---|---|---|
| **Shock absorbers** | | | |
| Type: double acting, telescopic | | low pressure gas | |
| Open (start of damping action) | mm | 508 ± 2.5 | 501 ± 2.5 |
| Closed (metal against metal) | mm | 361 ± 2.5 | 354 ± 2.5 |
| Travel | mm | 147 | |
| **Anti-roll bar** | | | |
| Diameter of anti-roll bar | mm | 18 | |

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# 00.44

### CLASSIFICATION OF SPRINGS ACCORDING TO VARIOUS VERSIONS AND ENGINE TYPES

| VERSIONS | ENGINE TYPES | | | |
|---|---|---|---|---|
| | 1242 TD | 1998 20v | 1910 JTD | 2387 JTD |
| Standard | G | | D | |
| Standard with ABS | G | | D | |
| With air conditioning | F | | C | |
| With air conditioning and all options | F | | | |
| With air conditioning, ABS and all options | F | | C | |
| With air conditioning and ABS | | | C | |
| With ABS (fitted as standard) | | B | | A |
| With ABS (fitted as standard) and air conditioning | | B | | A |
| With ABS (fitted as standard), air conditioning and all options | | B | | A |

### SPECIFICATIONS OF VARIOUS SPRINGS

| Coil springs | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| Diameter of wire mm | 13.6 ± 0.05 | | 13.5 ± 0.05 | | 13.2 ± 0.05 | | |
| Number of coils | 3.75 | | | | | | |
| Direction of coil | Clockwise | | | | | | |
| Height of spring released mm | 468 | 449 | 448 | 434 | 425 | 413 | 405 |
| Load under which height of spring is 173 mm daN | 461±18 | 432±17 | 417±17 | 397±16 | 368±15 | 350±14 | 338±13 |
| The springs have been divided into two categories identifiable by a mark yellow (*) for those with a height of >173 mm under a load of: green (*) for those with a height of ≤ 173 mm under a load of: | 461 daN | 432 daN | 417 daN | 397 daN | 368 daN | 350 daN | 338 daN |

(*) Springs of the same type must be fitted




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Rear suspension independent with track control arms anchored to an auxiliary crossmember. Variable flexibility coil springs and anti-roll bar. Gas shock absorbers with low friction coefficient lower bushes

| ENGINE TYPE | 1247 16v | 1910 20v | 1910 JTD | 1247 JTD |
|---|---|---|---|---|

### Coil spring

| | | |
|---|---|---|
| Diameter of wire | mm | 12.3 ± 0.1 |
| Number of coils | | 5.93 |
| Direction of coil | | clockwise |
| Height of spring released | mm | 3.16 |
| Height of spring under a load of: 360 daN | mm | 184 |
| The springs are divided into two categories, identifiable by a mark:<br>yellow (1) for those: 360 daN height of mm under a load of | | > 184 |
| green (1) for those: 360 daN height of mm under a load of | | ≤ 184 |

(1) Springs of the same type must be fitted.

### Shock absorbers

| | | |
|---|---|---|
| Type | | double acting, telescopic, gas |
| Open (start of damping action) | mm | 321 ± 2 |
| Closed (metal against metal) | mm | 224 ± 2 |
| Travel | mm | 97 |

### Anti-roll bar

| | | |
|---|---|---|
| Diameter of anti-roll bar | mm | 17 |

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Rear suspension independent with track control arms anchored to an auxiliary crossmember. Variable flexibility coil springs and anti-roll bar. Gas shock absorbers with low friction coefficient lower bushes.

| ENGINE TYPE | 1242 16v | 199? 20v | 1910 JTD | 239? JTD |
|---|---|---|---|---|

### Coil spring

| | | |
|---|---|---|
| Diameter of wire | mm | 12.8 ± 0.1 |
| Number of coils | | 5.93 |
| Direction of coil | | clockwise |
| Height of spring released | mm | 322 |
| Height of spring under a load of: 432 daN | mm | 184 |
| The springs are divided into two categories, identifiable by a mark:<br>yellow (1) for those: 432 daN height of mm under a load of | | > 184 |
| green (1) for those 432 daN height of mm under a load of: | | ≤ 184 |

(1) Springs of the same type must be fitted.

### Shock absorbers

| | | |
|---|---|---|
| Type | | double acting, telesopic, gas |
| Open (start of damping action) | mm | 321 ± 2 |
| Closed (metal against metal) | mm | 224 ± 2 |
| Travel | mm | 97 |

### Anti-roll bar

| | | |
|---|---|---|
| Diameter of anti-roll bar | mm | 17 |




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| | 1242 16v | 1998 20v | 1910 JTD | 2387 JTD |
|---|---|---|---|---|
| STARTER MOTOR | M. Marelli E80E-12v-0,9 kW | BOSCH Ø 74,2 12v – 1.1 Kw (with reduction gear) | BOSCH Ø 78.5 – 12V – 2.0 kW (with reduction gear) M. Marelli M70R-12V-1,8 kW (with reduction gear) | M. Marelli E9ER-12V-2,2 kW (with reduction gear) |
| ALTERNATOR | M. Marelli A115I-14V-38/65A M. Marelli A127IR-14V-50/85A (●) | M. Marelli A127IR-14V-50/85A M. Marelli A127IR-14V-55/100A (●) | M. Marelli A127IR-14V-50/85A M. Marelli A127IR-14V-55/100A | M. Marelli A127IR-14V-55/100A (1) BOSCH 14V-60/120A (2) |
| VOLTAGE REGULATOR | BUILT IN ELECTRONIC | | | |
| BATTERY | 12V-50Ah-250A | 12V-50Ah-250A 12V-60Ah-320A (▲) | 12V-60Ah-380A 12V-70Ah-450A (▲) | 12V-65Ah-450A |
| IGNITION SYSTEM | Bosch M1.5.5 MPI integrated electronic injection/ignition | Bosch Motronic ME 3.1 MPI integrated electronic injection/ignition | - | - |
| IGNITION COIL | BOSCH 0.221.503.407 | BOSCH 0.261.210.160 | - | - |
| SPARK PLUGS | FIAT RA4HCX FIAT DCPR8EKC | CHAMPION RC8 BYC | - | - |
| PRE-HEATING ELECTRONIC CONTROL UNIT | - | | BOSCH 0.281.003.215 | BOSCH 0.281.003.015 |
| ENGINE FUEL SYSTEM ELECTRONIC CONTROL UNIT | - | | BOSCH 0.281.001.928 | BOSCH 0.281.001.935 |
| HEATER PLUGS | - | | BOSCH 0.250.202.028 | |

(●) For vehicles with air conditioning
(▲) TAXI version only
(1) Validity also extended to vehicles with air conditioning
(2) For vehicles with air conditioning and additional heater

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| STARTER MOTOR | | 1242 16v | 1998 20v |
|---|---|---|---|
| Type | | M. Marelli E80-12V-0,9 kW | BOSCH Ø 74,2 12V – 1.1 kW (with reduction gear) |
| Voltage | V | 12 | |
| Nominal power | kW | 0.9 | 1.1 |
| Rotation, pinion side | | clockwise | |
| No. of poles | | 4 | |
| Winding | | series | |
| Engagement | | free wheel | |
| Operation | | Solenoid | |
| End float of armature shaft | mm | 0.1 - 0.5 | |
| **Data for bench test** | | | |
| Operating test (*): | | | |
| current | A | 180 (200) | 360 - 380 |
| speed | rpm | 1720 (2200) | 1150 |
| voltage | V | 9.5 (9.8 - 10) | 8.15 |
| torque developed | daNm | 0.37 (0.38) | 1.30 |
| Engagement test (*): | | | |
| current | A | 324 (440) | 680 - 700 |
| voltage | V | 7.1 (7.6) | 4.9 |
| torque developed | daNm | ≥ 0.97 (≥ 1.25) | 3.11 |
| Free running test (*): | | | |
| current | A | 40 (44 - 48) | 60 - 80 |
| voltage | V | 11.4 (11.4-11.5) | 4.9 |
| speed | rpm | 8500 - 9000 (11400-12300) | 4040 |
| **Relay** pull in Ω | | 0.30 - 0.32 (0.32) | 0.33 - 0.37 |
| Winding resistance (*) hold in Ω | | 1.2 - 1.3 (1.09) | 1.13 - 1.27 |
| **Lubrication** Internal splines and Shaft bushes | | VS+ SAE 10W | |
| Engagement sleeve and intermediate disc | | TUTELA MR3 | |

(*) Data obtained at an ambient temperature of 20°C

NOTE *When overhauling it is not necessary to undercut the insulator between the commutator bars*




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| STARTER MOTOR | | 1910 JTD | | 2387 JTD |
|---|---|---|---|---|
| Type | | BOSCH DIAM 78.5 – 12V – 2.0 kW (with reduction gear) | M. Marelli M70R-12V-1.8 kW (with reduction gear) | M. Marelli E95R-12V-2.2 kW |
| Voltage | V | 12 | | |
| Nominal power | kW | 2.0 | 1.8 | 2.2 |
| Rotation, pinion side | | clockwise | | |
| No. of poles | | 6 | 4 | 4 |
| Winding | | permanent magnets | series-parallel | series-parallel |
| Engagement | | free wheel | | |
| Operation | | solenoid | | |
| End float of armature shaft | mm | 0.1 - 0.5 | | 0.15 - 0.45 |
| **Data for bench test** | | | | |
| Operating test (*): | | | | |
| current | A | 500 | 400 | 600 |
| speed | rpm | 1950 | 1400 | 1400 |
| voltage | V | 7.30 | 9.60 | 7.9 |
| torque developed | daNm | 1.30 | 1.40 | 1.6 |
| Engagement test (*): | | | | |
| current | A | 1200 | 1100 - 1150 | 1110 - 1150 |
| voltage | V | 5.5 | 4.4 - 4.6 | 4.4 - 4.6 |
| torque developed | daNm | 3.0 | 5.0 | ≥ 3.9 |
| Free running test (*): | | | | |
| current | A | 70 - 80 | 120 - 140 | 120 - 140 |
| voltage | V | 11.5 | 11 | 11 |
| speed | rpm | 5450 - 5750 | 4750 -5000 | 4500 - 4750 |
| Relay | pull in Ω | 0.4 | 0.30 - 0.37 | 0.23 - 0.27 |
| Winding resistance (*) | hold in Ω | 1.7 | 1.2 - 1.3 | 0.93 - 1.07 |
| **Lubrication** | | VS+ SAE 10W | | |
| Internal splines and shaft bushes | | | | |
| Enagement sleeve and intermediate disc | | TUTELA MR3 | | |

(*) Data obtained at an ambient temperature of 20°C.

**NOTE** *When overhauling it is not necessary to undercut the insulator between the commutator bar.*

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| ALTERNATOR | 1242 16v | 1372 16v<br>1932 20v<br>1932 JTD | 1932 20v (●)<br>1910 JTD(■)<br>1932 JTD (●)<br>2387 JTD | 2382 JTD (▲) |
|---|---|---|---|---|
| Type | A115I-14V 38/65A | A127IR-14V 50/85A | A127IR – 14V 55/100A | Bosch 14V 60/120 |
| Nominal voltage of system V | 14 | | | |
| Maximum current A | 65 | 85 | 100 | 120 |
| Nominal current at 1800 rpm rpm | 38 | 50 | 55 | 60 |
| Nominal current at 6000 rpm A | 65 | 85 | 100 | 120 |
| Field winding resistance between the two slip rings (*) Ω | 2.4 | 2.6 | - | - |
| Direction of rotation (seen from control side) | Clockwise | | | |
| Diode power rectifiers | Bridge | | | |

(*) Data obtained at an ambient temperature of 20°C.
(■) For vehicles with air conditioning
(■) Supplied as an alternative
(▲) For vehicles with air conditioning and additional heater

| VOLTAGE REGULATOR | Built in electronic | |
|---|---|---|
| Type | RTM 151A (1) | RTM 151 B |
| Alternator speed for test rpm | 7000 | |
| Thermal stabilization corrector A | - | |
| Test current A | - | |
| Regulation voltage (*) V | 13.4 - 14.6 | |

(*) Data obtained at an ambient temperature of 23°C.

(1) Specific to 1242 16V version.




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| INTEGRATED ELECTRONIC INJECTION/IGNITION CONTROL MODULE | 1242 16v |
|---|---|
| Type | Bosch 0.261.204.578 |
| Firing order | 1 – 3 – 4 – 2 |

**IGNITION COIL WITH 4 HIGH TENSION INTAKES**

| | | |
|---|---|---|
| Make | | Bosch |
| Type | | 0.221.503.407 |
| Ohmic resistance of primary winding at 20°C | Ω | 0.45 ÷ 0.55 |
| Ohmic resistance of secondary winding at 20°C | Ω | 12000 ÷ 14600 |

**TOP DEAD CENTRE AND RPM SENSOR**

| | | |
|---|---|---|
| Make and type | | Bosch 0.281.210.124 |
| Sensor winding resistance at 20°C | Ω | 486 ÷ 594 |
| Distance (gap) between sensor and crankshaft pulley tooth | mm | 0.8 ÷ 1.5 |

**SPARK PLUGS**

| | | |
|---|---|---|
| Make and type | | FIAT RA4 HCX<br>FIAT DCPR BEKC |
| Thread | | M 14 x 1.25 |
| Electrode gap | mm | 0.8 |

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## 00.55

| INTEGRATED ELECTRONIC INJECTION/IGNITION SYSTEM | 1998 20v |
|---|---|
| Make | Bosch 0.261.204.271 |
| Firing order | 1 – 2 – 4 – 5 – 3 |

### IGNITION COIL (1 PER SPARK PLUG)

| | | |
|---|---|---|
| Make | | Bosch |
| Type | | 0.221.504.014 |
| Ohmic resistance of primary winding at 20°C | Ω | 0.,4 |
| Ohmic resistance of secondary winding at 20°C | Ω | 8500 |

### TOP DEAD CENTRE AND RPM SENSOR

| | | |
|---|---|---|
| Make and type | | Bosch 0.261.210.160 |
| Sensor winding resistance at 20°C | Ω | 774 ÷ 946 |
| Distance (gap) between sensor and crankshaft pulley tooth | mm | 0.8 ÷ 1.5 |

### DETONATION SENSOR

| | |
|---|---|
| Make | Bosch |
| Type | 0.261.231.131 |

### SPARK PLUGS

| | | |
|---|---|---|
| Make and type | | CHAMPION RC8BYC |
| Thread | | M 14 x 1.25 |
| Electrode gap | mm | 0.8 |




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| Tool number | NAME OF TOOL | ENGINE TYPE 1242 16v |
|---|---|---|

GEARBOX-DIFFERENTIAL

| | | |
|---|---|---|
| **1842133000** | Tool for dismantling differential bearing and gearbox gears | ● |
| **1842134000** | Tool for dismantling gears and gearbox hubs | ● |
| **1845028000** | Tool for removing differential bearings | ● |
| **1845057000** | Tool for removing layshaft 5th speed gear bush | ● |
| **1847017001** | Tool (to be used with **1860889000**) | ● |
| **1847056000** | Tool for extracting differential output shafts | ● |
| **1850113000** | Spanner (12 mm) for gearbox oil drain plug | ● |
| **1855035000** | Spanner (19 mm) for removing and refitting gearbox | ● |
| **1860691000** | Drift for removing and refitting gear hardening ball plug | ● |
| **1860851000** | Crossmember for removing-refitting gearbox | ● |
| **1860851001** | Crossmember adapator for removing-refitting gearbox (to be used with **1860851000**) | ● |
| **1860873000** | Bracket for removing-refitting gearbox | ● |
| **1860889000** | Two-way connector for tool (to be used with **1847017001**) | ● |
| **1861000000** | Rotating stand for overhauling engine (also used for gearboxes and differentials) | ● |
| **1870007000** | Grip for drifts and fitting tools | ● |
| **1870152000** | Drift for fitting hubs and gears on main and layshafts | ● |
| **1870419000** | Tool for fitting main shaft gasket on bell housing (to be used with **1870007000**) | ● |

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# 00.A

| Tool number | NAME OF TOOL | ENGINE TYPE 1242 16v |
|---|---|---|
| **1870469000** | Tool for fitting differential bearing (to be used with **1870007000**) | ● |
| **1870629000** | Drift for fitting differential housing cover gasket (to be used with **1870007000**) | ● |
| **1870630000** | Drift for fitting differential housing gasket (to be used with **1870007000**) | ● |
| **1870631000** | Drift for fitting main and layshaft bearings and gears | ● |
| **1870632000** | Drift for fitting bearings | ● |
| **1870633000** | Drift for fitting clutch release control shaft bush | ● |
| **1871000000** | Rotating stand for overhauling gearboxes and differentials | ● |
| **1871001014** | Support for gearbox-differential unit whilst overhauling (to be fitted to **1861000000** or **1871000000**) | ● |
| **187414001** | Pliers for staking nuts | ● |
| **1874140005** | Pair of tools for staking gearbox shaft nuts (to be used with **1874140001**) | ● |
| **1875088000** | Drift for fitting main and layshaft bearings | ● |
| **1881124000** | Pliers for adjusting main and layshaft rear bearing circlips | ● |
| **1895655000** | Tool for determining thickness of differential bearing adjustment shims (to be used with **1895884000**) | ● |
| **1895884000** | Dial gauge (measuring capacity **5** mm; shank length **16.5** mm) | ● |




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| DESCRIPTION | Thread | Tightening torques daNm | ENGINE TYPE 1242 16v | ENGINE TYPE 1910 JTD | ENGINE TYPE 2387 JTD |
|---|---|---|---|---|---|
| **ENGINE** | | | | | |
| Bearing cap fixing, flanged bolt | M10 | 2+90° | ● | | |
| | M12 | 2+100° | | ● | ● |
| Shield (dust cover) fixing, bolt | M6 | 0.9 | | ● | ● |
| Sump oil drain plug | M18 | 2 | | ● | ● |
| Oil sump fixing, bolt | M6 | 1 | ● | | |
| | | 0.1 | | ● | ● |
| | M8 | 2.5 | | ● | ● |
| Flywheel side and timing side cover fixing, bolt | M6 | 0.9 | | ● | ● |
| | | 1 | ● | | |
| Timing cover shields fixing, bolt | M8 | 2.2 | ● | | |
| | M6 | 0.9 | ● | ● | ● |
| Cylinder head to cylinder block fixing, bolt | M9 | 4+90° | | | |
| | M10 | 6.5+90°+ | | | |
| | M12 | 90°+90° | | | |
| Engine support to cylinder block/crankcase fixing, bolt | M8 | 2.2 | ● | | |
| | M10 | 5 | | ● | ● |
| Camshaft cap fixing, nut and bolt | M6 | 1 | | ● | |
| | M7 | 1.5 | | ● | ● |
| Tappet cover to cylinder head fixing, bolt | M6 | 1 | | ● | ● |
| Inlet manifold to cylinder head fixing, nut | M7 | 1.5 | ● | | |
| | M8 | 2.5 | | ● | ● |
| Exhaust manifold to cylinder head fixing, nut | M8 | 2.5 | | ● | ● |
| | | 2.7 | ● | | |
| Connecting rod caps fixing, bolt | M8 | 4.1 | ● | | |
| | | 2 + 60° | | ● | ● |
| Engine flywheel fixing, bolt | M8 | 4.4 | ● | | |
| | M12 | 16 | | ● | ● |
| Crankshaft gear fixing bolt (*) | M12 | 2+90° | ● | | |
| | M16 | 34 | | ● | ● |
| Auxiliary pulley to crankshaft gear fixing, bolt | M8 | 2.5 | | ● | ● |
| Gear on camshaft (inlet and/or exhaust) fixing, bolt | M12 | 12 | ● | ● | ● |

(*) The bolt should not be lubricated

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# 00.

| DESCRIPTION | Thread | Tightening torque daNm | ENGINE TYPE 1242 16v | 1910 JTD | 2387 JTD |
|---|---|---|---|---|---|
| Sensors to cylinder block/crankcase and cylinder head fixing, flanged bolt | M6 | 0.9 | | ● | ● |
| Oil pump to crankcase fixing, bolt | M6 | 0.9 | | ● | |
| | | 1 | | | ● |
| Oil dipstick fixing, nut and bolt | M6 | 0.9 | | | ● |
| Water pump fixing, nut and bolt | M6 | 1 | ● | | |
| | M8 | 2.5 | | ● | ● |
| Thermostat to cylinder head fixing, bolt | M8 | 2.5 | | ● | |
| Lower bracket to alternator mounting and alternator fixing, bolt | M10 | 5 | | ● | ● |
| | M12 | 7 | | ● | ● |
| Compressor fixing, bolt | M8 | 2.2 | ● | | |
| | M10 | 5 | ● (*) | ● | ● |
| Auxiliary units fixed belt tensioner fixing, nut and bolt | M8 | 2.5 | ● | ● | ● |
| Power assisted steering pump fixing, bolt | M8 | 2.5 | | ● | ● |
| Pulley to power assisted steering pump fixing, bolt | M8 | 2.5 | | ● | ● |
| Water temperature sender unit fixed to cylinder head | M16 tapered | 2.5 | | ● | |
| | | 3 | | | ● |
| | | 3.4 | ● | | |
| Water temperature sender unit | M12 | 1.2 | ● | | |
| | | 2 | | | ● |
| | | 3 | | ● | |
| Connecting rod mounting bracket fixing, bolt | M10 | 5 | | ● | |
| Alternator strut fixing, bolt | M8 | 2.5 | | ● | |
| Driveshaft support fixing, bolt | M10 | 5 | | ● | ● |
| Oil level sender unit | M12 | 3 | | | ● |
| Oil pressure switch on cylinder block/crankcase | M14 | 3 | | ● | ● |
| | | 3.2 | ● | | |

* Value for versions with air conditioning




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| DESCRIPTION | Thread | Tightening torques daNm | ENGINE TYPE 1242 16v | 1910 JTD | 2387 JTD |
|---|---|---|---|---|---|
| Automatic belt tensioner to alternator mounting fixing, bolt | M8 | 3.2 | | | ● |
| | M10 | 6 | | | ● |
| Fixed belt tensioner to air conditioning compressor mounting fixing, bolt | M10 | 5 | | ● | ● |
| Intake to cap fixing, bolt | M6 | 0.9 | | | ● |
| Sump to driveshaft support fixing, nut for bolt | M8 | 2.5 | | | ● |
| Power assisted steering pump to connecting rod support fixing, bolt | M8 | 2.5 | | | ● |
| Oil vapour separator to inlet manifold fixing, nut | M6 | 0.9 | | ● | ● |
| Auxiliary support to cylinder block/crankcase fixing, flanged bolt | M8 | 2.5 | | ● | |
| | M10 | 5 | | ● | ● |
| Ring nut fixing injectors | M35 | 12 | | ● | ● |
| Exhaust manifold to cylinder block/crankcase reaction bracket fixing | M8 | 2.5 | | ● | ● |
| Injection pump to mounting, cylinder block/crankcase and inlet manifold fixing, bolt | M8 | 2.5 | | ● | ● |
| Reaction bracket to injection pump fixing, nut | M8 | 2.5 | | ● | ● |
| Injection pump gear fixing, nut and bolt | M14 | 5 | | ● | ● |
| Complete injector | M24 | 6 | | ● | ● |
| Fuel filter to inlet manifold fixing, nut | M8 | 2.5 | | | ● |
| Turbocharger to exhaust manifold fixing, nut | M8 | 2.5 | | ● | ● |
| Exhaust manifold connector to turbocharger fixing, nut | M8 | 2.5 | | | ● |
| Filler for oil supply pipe to turbocharger | M12 | 1.5 | | ● | ● |

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# 00.

| DESCRIPTION | Thread | Tightening torques daNm | ENGINE TYPE 1242 16v | 1910 JTD | 2387 JTD |
|---|---|---|---|---|---|
| Thermostatic valve fixing connector | M20 | 6 | | ● | ● |
| Complete jet to cylinder block/crankcase fixing, bolt | M6 | 0.9 | | ● | ● |
| Water outlet front filler to cylinder head fixing, bolt | M6 | 0.9 | | | ● |
| | M8 | 2.5 | | | ● |
| Thermostat to water outlet filler from cylinder head fixing, bolt | M7 | 1.5 | | | ● |
| Alternator upper and lower reaction brackets fixing, bolt | M10 | 5 | | | ● |
| Vacuum unit to cylinder head fixing, bolt | M8 | 2.5 | | ● | ● |
| EGR valve to exhaust manifold fixing, nut | M8 | 2.5 | | ● | ● |
| Pipe to EGR valve fixing, bolt | M8 | 2.5 | | ● | ● |
| Pipe to exhaust or inlet manifold fixing, nut | M6 | 0.9 | | | ● |
| Air pressure switch | M12 | 2 | | | ● |
| Heater plugs | M12 | 1.5 | | ● | ● |
| Reaction bracket to exhaust manifold fixing, bracket | M8 | 2.5 | | | ● |
| Lytens automatic tensioner fixing, nut | M8 | 2.5 | | ● | |
| Oil filter | M20 | 1.5 | | ● | ● |
| Fuel supply pipe to the injection pump fixing, nut | M12 | 2.5 | | ● | |
| Rigid pipe to turbocharger for draining oil fixing, bolt | M8 | 2.5 | | ● | |
| Bracket to crankcase for fixing exhaust manifold reaction bracket fixing, bolt | M8 | 2.5 | | ● | |
| | M10 | 5 | | ● | |




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| DESCRIPTION | Thread | Tightening torques daNm | ENGINE TYPE 1242 16v | 1910 JTD | 2387 JTD |
|---|---|---|---|---|---|
| EGR pipe to exhaust manifold fixing, ring nut | M22 | 5 | | ● | |
| Earth lead fixing, bolt | M8 | 2.2 | ● | | |
| | | 2.5 | | ● | |
| Electrical connections for spark plugs fixing, nut | M4 | 0.3 | | ● | ● |
| Heat shield to exhaust manifold fixing, TE bolt | M6 | 0.9 | ● | ● | |
| Rigid pipe to crankshaft for draining turbo-charger oil fixing, bolt | M8 | 2.5 | | ● | |
| Air conditioning to support fixing, bolt | M8 | 2.5 | | ● | |
| Rigid pipe to power assisted steering pump fixing, ring nut | M16 | 3.5 | | ● | |
| Power assisted steering pipe to pump fixing, bolt | M8 | 2.5 | | ● | |
| Spark plugs | M12 | 2.7 | ● | | |
| Cap plate fixing, bolt | M7 | 1.5 | ● | | |
| Water inlet pipe to crankcase fixing, bolt | M6 | 1 | ● | | |
| Camshaft housing fixing, bolt | M8 | 1.5 | ● | | |
| Plate to oil pump casing fixing, bolt | M6 | 0.7 | ● | | |
| Camshaft housing fixing bolt sealing plug | M16 | 1.5 | ● | | |
| Pulley fixing bolt (flywheel) | M8 | 2.2 | ● | | |
| Mounting to engine support fixing, nut | M10 | 6 | ● | | |
| Oil temperature switch | M16 tapered | 3.4 | ● | | |

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| DESCRIPTION | Thread | Tightening torques daNm | ENGINE TYPE 1242 16v | 1910 JTD | 2387 JTD |
|---|---|---|---|---|---|
| Connector on inlet duct for vacuum intake | M14 tapered | 3.4 | ● | | |
| Inlet manifold fixing, bolt | M6 | 0.7 | ● | | |
| Valve gear timing stud sealing plugs | M6 | 1.5 | ● | | |
| Rear cover coil support fixing, nut | M6 | 0.9 | ● | | |
| Coils to cover fixing, bolt | M4 | 0.2 | ● | | |
| Tapered plug on camshaft housing, rear side | M14 tapered | 1.5 | ● | | |
| Tapered plug on camshaft housing, front side | M20 tapered | 4 | ● | | |
| Plug in camshaft housing fixing manifold | M18 | 3 | ● | | |
| Butterfly casing fixing, bolt | M6 | 0.7 | ● | | |
| Sensor to oil pump fixing, bolt | M6 | 1 | ● | | |
| Recharging cable to alternator fixing, nut | M8 | 2.5 | ● | | |
| Alternator rear track to bracket fixing, bolt | M10 | 5 | ● | | |
| Alternator to slot fixing, bolt (1) | M10 | 5 | ● | | |
| Alternator to filter fixing, bolt | M10 (*) | 5 (*) | ● (*) | | |
| | M12 | 8 | ● | | |
| Front and rear brackets and reinforcement bolt fixing, bolt | M10 | 5 | ● | | |
| Front bracket, cylinder block/crankcase, centre bracket fixing, bolt | M10 | 5 | ● | | |
| Rear bracket fixing, bolt | M10 | 5 | | | |

(1) Also valid for versions with air conditioning

(*) Value for versions with air conditioning only




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| DESCRIPTION | Thread | Tightening torques daNm | ENGINE TYPE 1242 16v | 1910 JTD | 2387 JTD |
|---|---|---|---|---|---|
| Bracket to crankcase fixing, bolt (air conditioning) | M10 | 5 | ● | | |
| Compressor tensioner fixing, bolt | M10 | 5 | ● | | |
| Compressor fulcrum fixing, nut | M10 | 5 | ● | | |
| Power assisted steering plate fixing, bolt | M8 | 2.2 | ● | | |
| | M10 | 5 | ● | | |
| Power assisted steering support to crankcase fixing, bolt | M10 | 5 | ● | | |
| Compressor/alternator rear support to crankcase fixing, nut and bolt | M10 | 5 | ● | | |
| Alternator fixing, bolt | M10 | 5 | ● | | |
| | M12 | 8 | ● | | |
| Tensioner/alternator fixing, bolt | M8 | 2.2 | ● | | |
| Plate to crankcase fixing, bolt | M10 | 5 | ● | | |
| Engine support to cylinder block/crankcase fixing, nut | M8 | 2.5 | ● | | |
| | M10 | 6 | ● | | |

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# Introduction and technical data

## Index

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**NOTE** – *This section contains the variants for the 1747 16v version with a returnless fuel system. For anything not dealt with, refer to the information in print no. 506.763 and subsequent updates.*

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| | CHASSIS | ENGINE | VERSION | MAREA | MAREA WEEKEND | GEARBOX |
|---|---|---|---|---|---|---|
| 1747 | ZFA 185 000 | 182 A2.000 | 185 AX C1A 02 | ● | | 1 3 5 / 2 4 R |
| | | | 185 AX C1A 02B (▲) | ● | | |
| | | | 185 AX C1A 02C (●) | ● | | |
| | | | 185 BX C1A 06 | | ● | |
| | | | 185 BX C1A 06B (▲) | | ● | |
| | | | 185 BX C1A 06C | | ● | |

▲ Versions for specific markets (finance) ● Voluntary for Germany

| ENGINE TYPE | 1747 16v |
|---|---|

**WEIGHTS** (in **kg**)

| | | | | | |
|---|---|---|---|---|---|
| ***Marea*** | 1085 | 1140 | 1165 | 1195 | 1255 |
| ***Marea Weekend*** | 1145 | 1200 | 1225 | 1255 | 1315 |
| ***Marea*** +590= (575)* 240 / 225 * | 1675 | 1730 | 1755 | 1785 | 1830 |
| ***Marea Weekend*** +595= (580)* 245 / 230 | 1740 | 1795 | 1820 | 1850 | 1895 |

**NOTES FOR VERSIONS WITH ACCESSORIES:** In the presence of special equipment (non standard air conditioning, sun roof, trailer towing device, etc.), the empty weight increases and therefore the carrying capacity may decrease in relation to the maximum permissible loads.

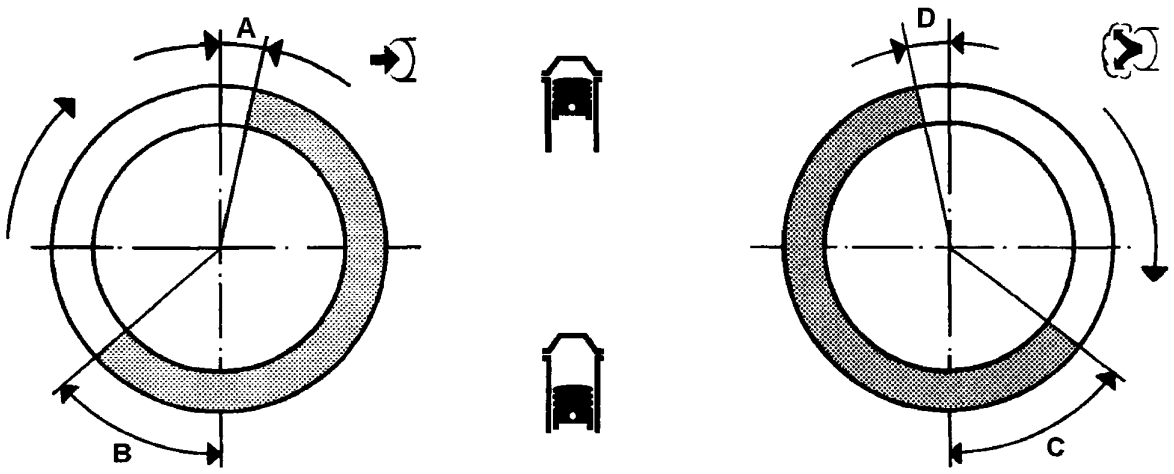
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# 00.10

## TIMING DIAGRAMS




| | | | | 1747 16v |
|---|---|---|---|---|
| A | Inlet | | opens before TDC | 0° after TDC |
| B | | | closes after BDC | 27° |
| C | Exhaust | | opens before BDC | 29° |
| D | | | closes after TDC | 2° |



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| INTEGRATED ELECTRONIC INJECTION/IGNITION SYSTEM COMPONENTS | 1747 16v |
|---|---|
| Electronic control unit | HITACHI MFI – 155<br>HITACHI MFI – 160 (*) |
| Injector | Marelli IWP 006 |
| Fuel pressure regulator (incorporated in the electric pump) | Marelli RPM 84 |
| Coolant temperature sensor | Jaeger 40218301<br>Elth 2690350 |
| Electric fuel pump | Marwall ESS 276 |
| Lambda sensor | NTK OZA 341-A1 |
| Idle actuator | HITACHI GL 108771 |
| Butterfly valve position sensor (potentiometer) | HITACHI GL 212875 |
| Fuel vapour solenoid valve | MARELLI EC1 |
| Top Dead Centre and rpm sensor | HITACHI RS – 314 |
| Detonation sensor | NGK KNE 03-A |
| Timing sensor | Bosch B.232.101.037 |
| Butterfly casing | HITACHI M646 WA |

(*) Specific versions for German market

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## 00.55

| INTEGRATED ELECTRONIC INJECTION/IGNITION SYSTEM | 1747 16v |
|---|---|
| Type | HITACHI MFI – 1 |
| Firing order | 1 – 3 – 4 – 2 |

### COIL (1 PER SPARK PLUG)

| | | |
|---|---|---|
| Make | | HITACHI |
| Type | | GE 215492 |
| Ohmic resistance of primary winding at 20°C | Ω | 0.66 |
| Ohmic resistance of secondary winding at 20°C | Ω | - |

### RPM AND TOP DEAD CENTRE SENSOR

| | | |
|---|---|---|
| Make and type | | HITACHI GE 110492<br>RS - 314 |
| Sensor winding resistance at 20°C | Ω | 513 ÷ 627 |
| Distance (gap) between the sensor and the crankshaft pulley tooth | mm | 0.4 ÷ 1.2 |

### DETONATION SENSOR

| | |
|---|---|
| Make and type | NTK KNE 03-A |

### CYLINDER RECOGNITION AND TIMING SENSOR

| | |
|---|---|
| Make and type | Bosch B 232.101.037 |

### ENGINE ADVANCE

| | |
|---|---|
| With engine idling (850 ± 50 rpm) | 9° ± 1° |

### SPARK PLUGS

| | | |
|---|---|---|
| Make and type | | NGK BKR6EKC<br>Champion – RC8BYC |
| Thread | | M 14x1.25 |
| Electrode gap | mm | 0.8 |




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| Tool number | TOOL NAME | ENGINE TYPE |
|---|---|---|
| | | 1747 16v |

ENGINE

| | | |
|---|---|---|
| 1860955000 | Equipment for checking fuel consumption | ● |
| 1870684000 | Connector for discharging petrol pressure | ● |
| 1870697000 | Tool for timing camshaft | ● |



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# Introduction and technical data

## Contents

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**INTRODUCTION**

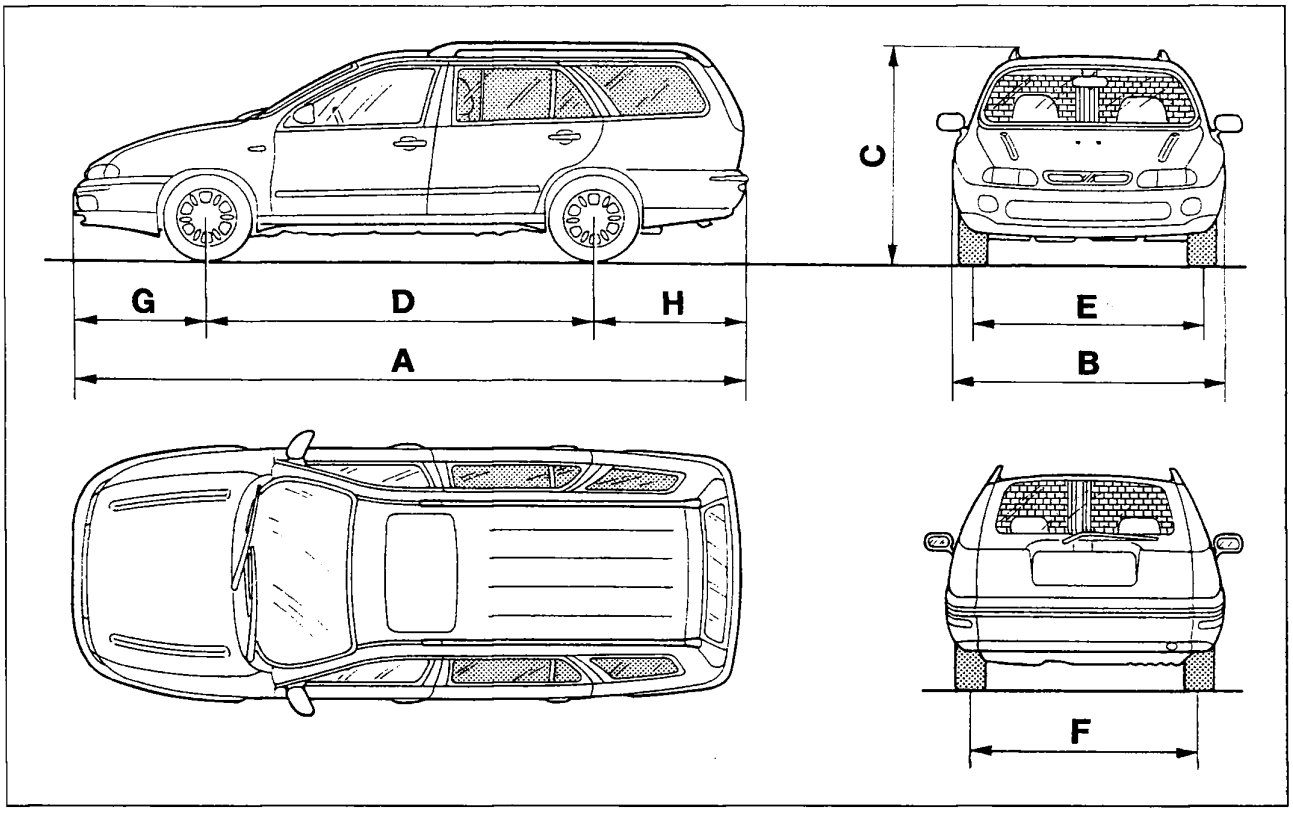
- Identification data 1
- Weights 2

**TECHNICAL DATA**

Engine
- Rear - front suspension 3

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| | CHASSIS | ENGINE | VERSION | GEARBOX |
|---|---|---|---|---|
| 1910 TD 75 | ZFA 185000 | 182 A8.000 | 185 CXF1A01 | ☆ |
| 1910 JTD 105 | | 182 B4.000 | 185 CX N1A 02 | ☆ |




P4G001A1

- Load carrying capacity 1590 $dm^3$

| Engine type | DIMENSIONS (mm) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H |
| 1910 TD 75 – JTD 105 | 4490 | 1741 | 1510 | 2540 | 1470 | 1440 | 884 | 1066 |

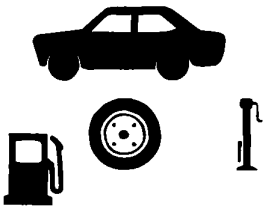


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## 00.0

| ENGINES | 1910 TD 75 | 1910 JTD 105 |
|---|---|---|

**WEIGHTS** (values expressed in kg)

| | | | |
|---|---|---|---|
|  | | 1245 | 1275 |
| | + 570 =  | 1815 | 1845 |
| Maximum loads permitted on axles |  | 1060 | 1060 |
| |  | 1060 | 1060 |

**Performances - Fuel consumption**

| | | | |
|---|---|---|---|
| Speed km/h (average load  |  | 36 | 36 |
| |  | 62 | 62 |
| |  | 96 | 97 |
| |  | 135 | 136 |
| |  | 163 | 183 |
| |  | 36 | 36 |
|   Fuel consumption as per CUNA standards (litres/100 km) | | 5.6 | 5,0 |

**Wheels**
Tubeless tyres with radial tread, type 185/65R14-B6H
Pressed sheet steel wheel rim, type 5½J x 14" - 43




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**Rear suspension** independent with tie rods anchored to a subframe Variable rate coil springs and anti-roll bar Gas dampers with low friction coefficient lower bushes

| ENGINE VERSION | 1910 TD 75 – JTD 105 |
|---|---|

### Coil sping

| | | | |
|---|---|---|---|
| Wire diameter | | mm | 13.9 ± 0.1 |
| Effective number of coils | | | 5.93 |
| Coil direction | | | clockwise |
| Spring height when released | | mm | 323 |
| Spring height under a load of: | 440 daN | mm | 207 |
| Springs are sorted into two categories, which are identified by markings: | | | |
| yellow (1) springs exerting a load of: | 440 daN height of mm | | > 207 |
| green (1) springs exerting a load of: | 440 daN height of mm | | ≤ 207 |

(1) When assembling, fit together springs with the same marking

### Dampers

| | | |
|---|---|---|
| Type | | gas, telescopic, double-acting |
| Open (start of damping effect) | mm | 321 ± 2 |
| Closed (steel against steel) | mm | 224 ± 2 |
| Travel | mm | 97 |

### Anti-roll bar

| | | |
|---|---|---|
| Anti-roll bar diameter | mm | 19 |

## FRONT SUSPENSION

### Anti-roll bar

| | | |
|---|---|---|
| Anti-roll bar diameter | mm | 18 |

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REMOVING-REFITTING

- Removing-refitting power unit 1
- Separating gearbox-differential unit 10

REPLACING AUXILIARY SHAFT DRIVE BELT

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REPLACING TIMING BELT

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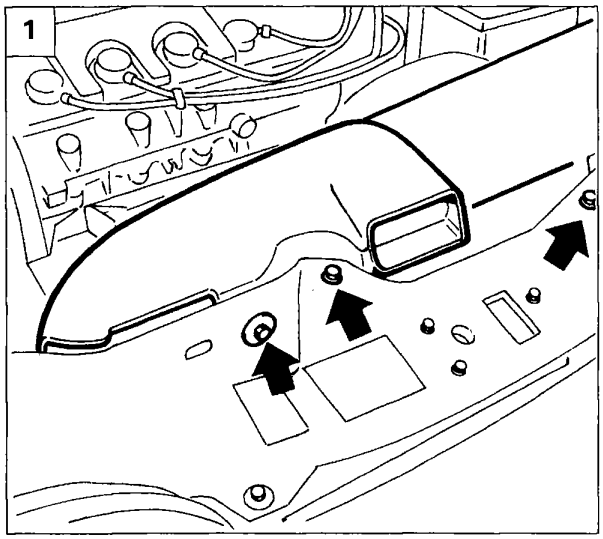
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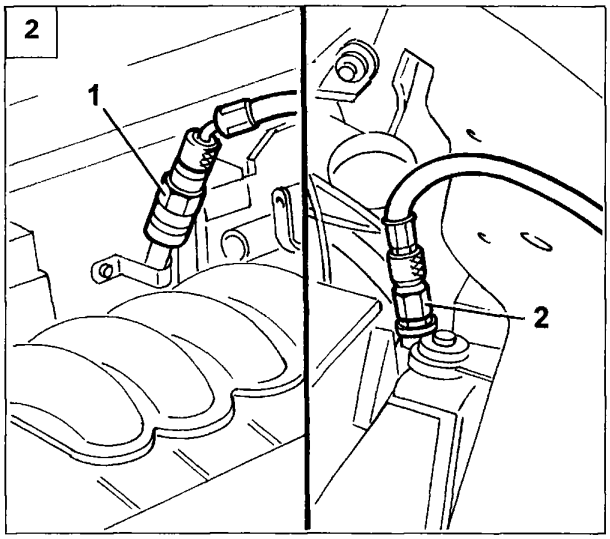
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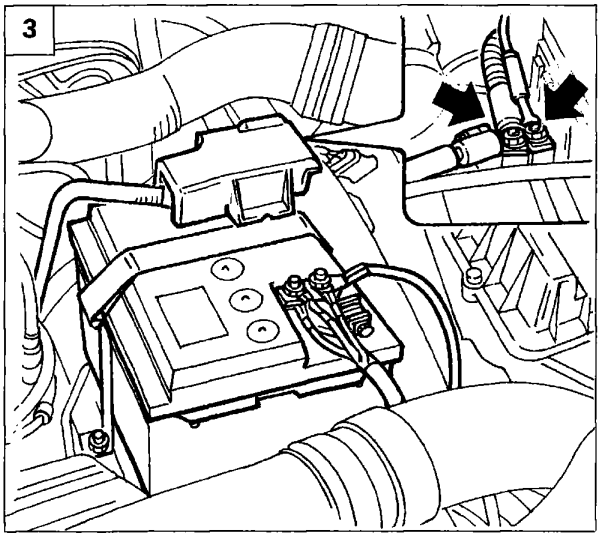
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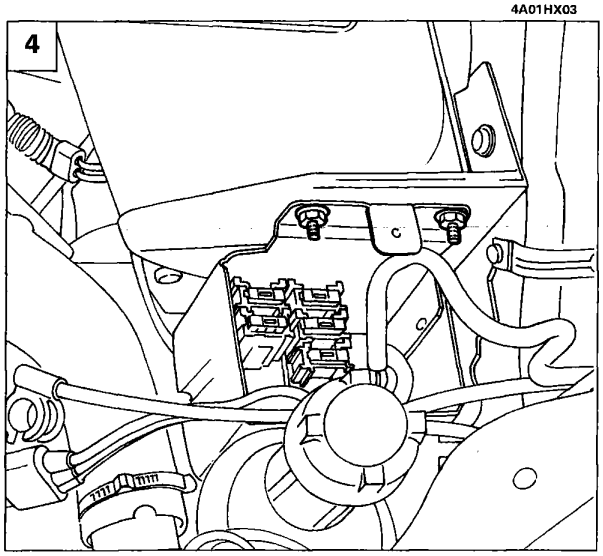

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4A01HX03




4A001B03

## REMOVING-REFITTING POWER UNIT

Position the vehicle on a lift, remove the front wheels, then proceed as described below:

1. Undo the three fixing bolts and remove the air intake, disconnecting it from the air filter first.
2. Drain the air conditioning system using the special equipment, connecting the pipe marked with the light blue connector (1) to the low pressure circuit needle valve and the pipe marked with the red connector (2) to the high pressure circuit needle valve.

*Wear gloves and goggles during the operation of draining the system for protection against contact with any jets of R134A. In order to facilitate the draining of the refrigerant from the vehicle air conditioning system, it should be left running for 10-15 minutes first.*

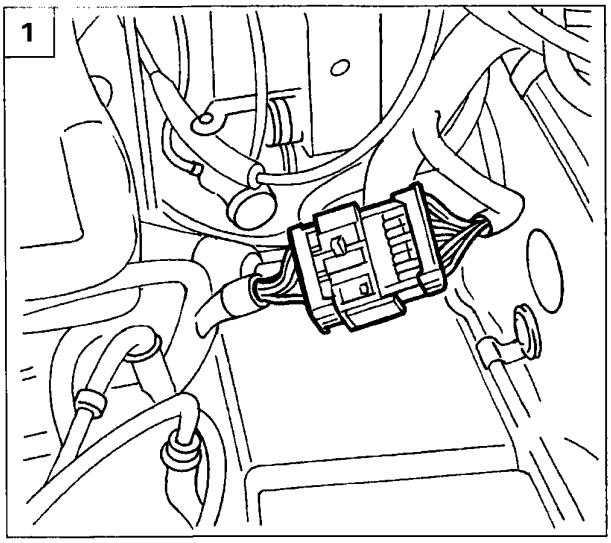
3. Disconnect the negative battery terminal, remove the protective cover for the positive terminal, disconnect the lead and separate the starter motor supply leads from the latter; undo the nut retaining the battery to the drip tray, then remove the latter from the engine compartment.
4. Undo the bolt retaining the relay casing cover and remove it, then unto the nuts fixing the casing to the battery drip tray and place the casing at the side.

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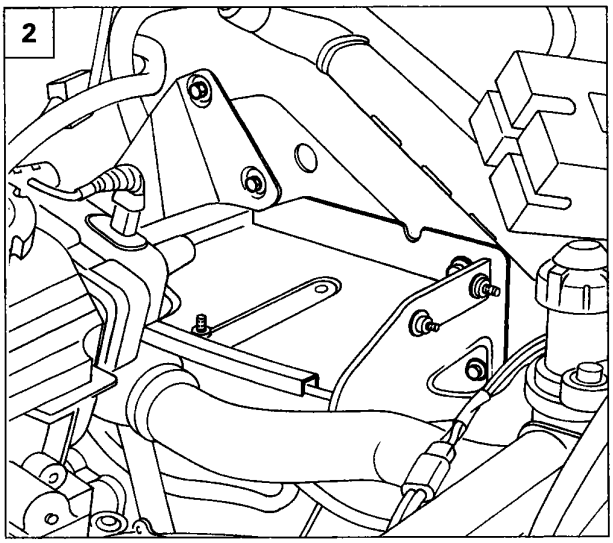


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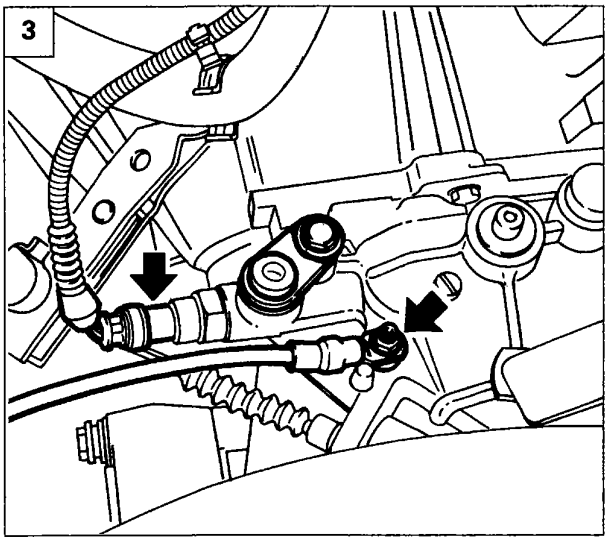
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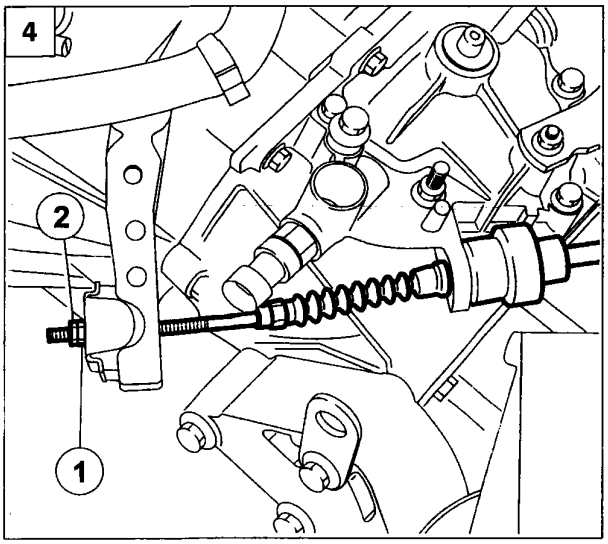



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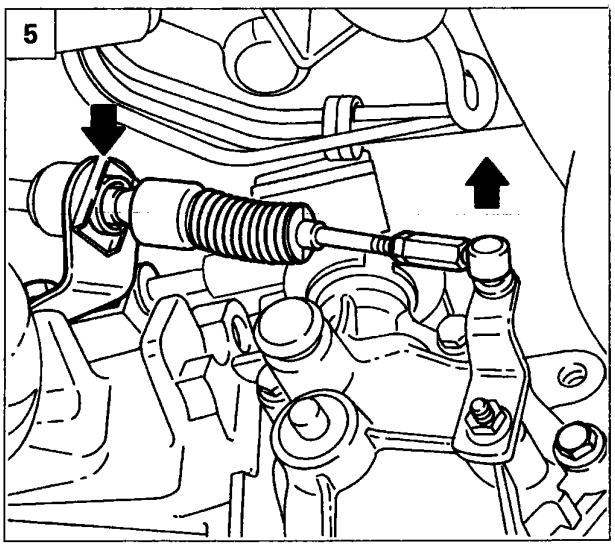



4A02HX02

1. Disconnect the injection cable coupling shown in the diagram.
2. Remove the battery drip tray, undoing the bolts fixing it to the bodyshell.
3. Disconnect the reversing lights switch connector and the earth lead.
4. Working on the nut (1) and the locknut (2), disconnect the clutch cable from the control lever.
5. Disconnect the gear engagment cable track rod end, lift up the retaining fork shown in the diagram, then remove the cable from the mounting bracket.



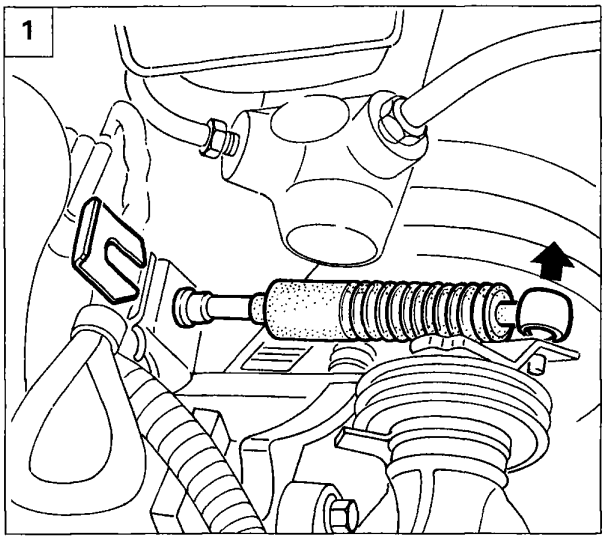

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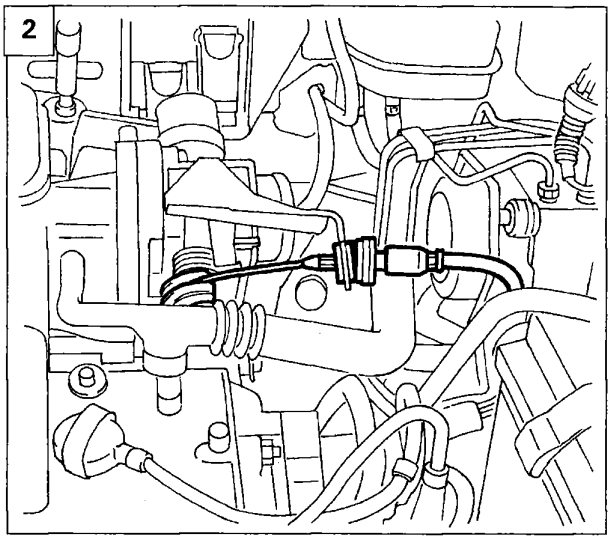

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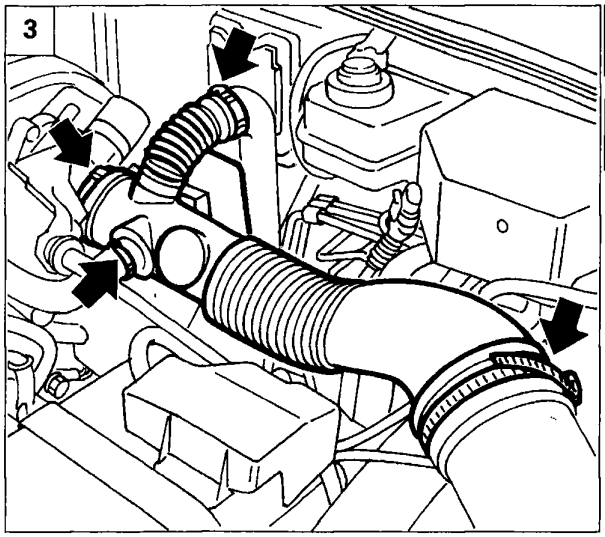
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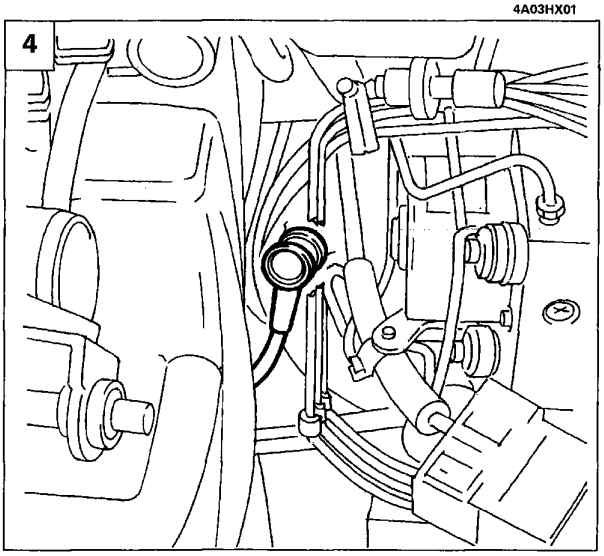



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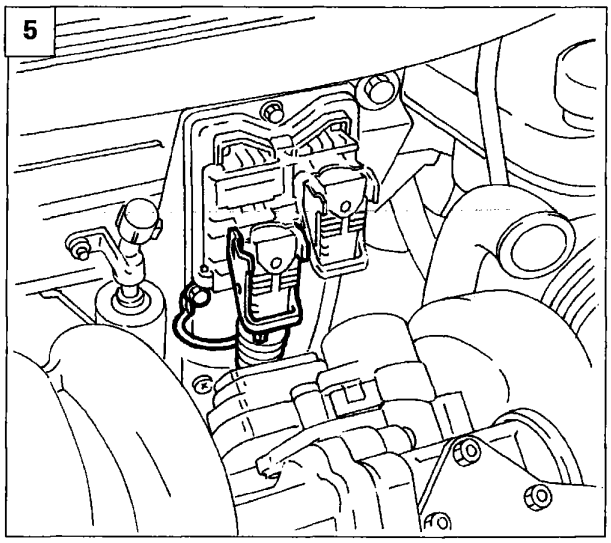



4A03HX01

1. Disconnect the gear selector cable track rod end, lift up the retaining fork shown in the diagram, then position the assembly to the side in the engine compartment.
2. Disconnect the accelerator cable.
3. Disconnect the bands illustrated in the diagram, then remove the air intake hose.
4. Disconnect the vacuum pipe from the brake servo.
5. Disconnect the connector shown in the diagram from the injection/ignition control unit and remove the earth lead from the control unit support.




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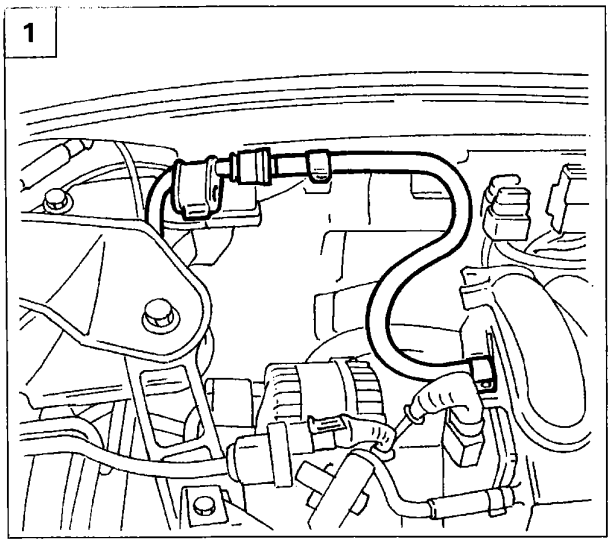

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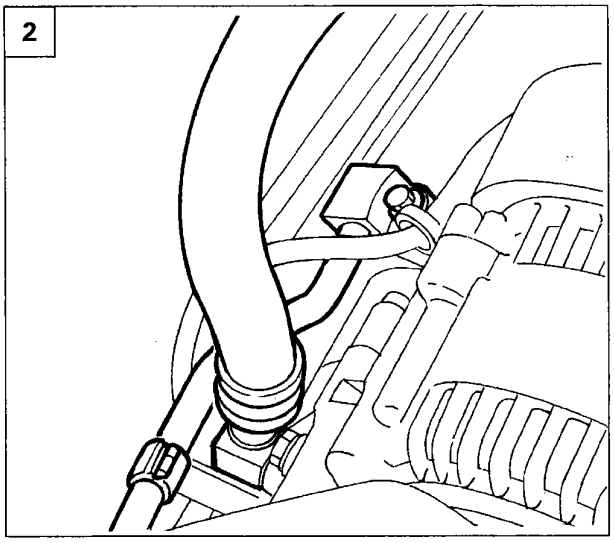
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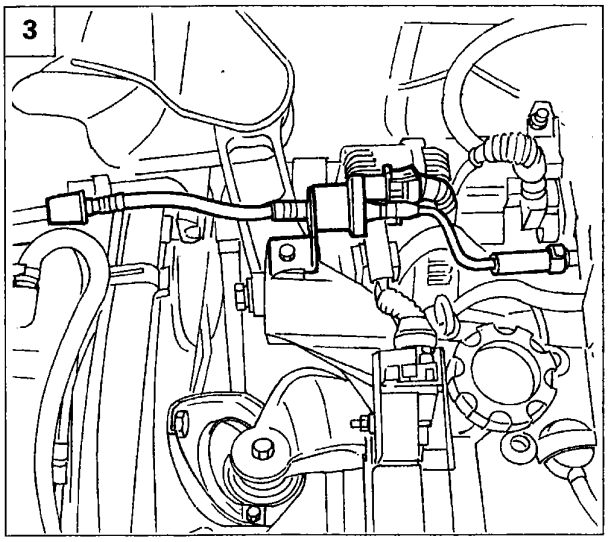
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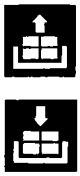


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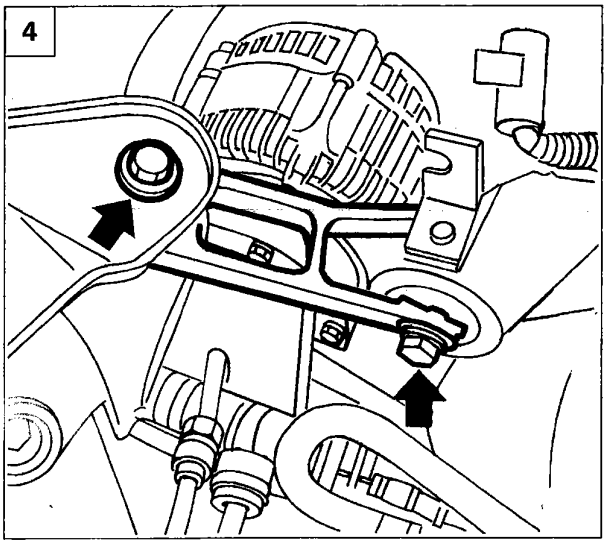


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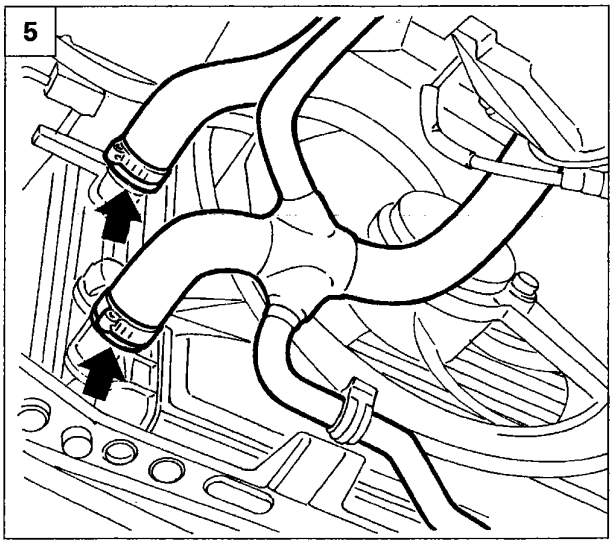
1. Disconnect the fuel supply pipe acting on the rapid attachment.
2. Disconnect the air conditioning system compressor supply and inlet pipes.
3. Disconnect the fuel vapour recovery pipe acting on the rapid attachment, remove the canister soleniod valve opening electrical connection, then remove the entire pipe from the mounting bracket, disconnecting the band fixing it to the inlet manifold.
4. Undo the bolts fixing the reaction rod, then remove it.
5. Drain the engine coolant, disconnecting the pipes shown in the diagram.

4



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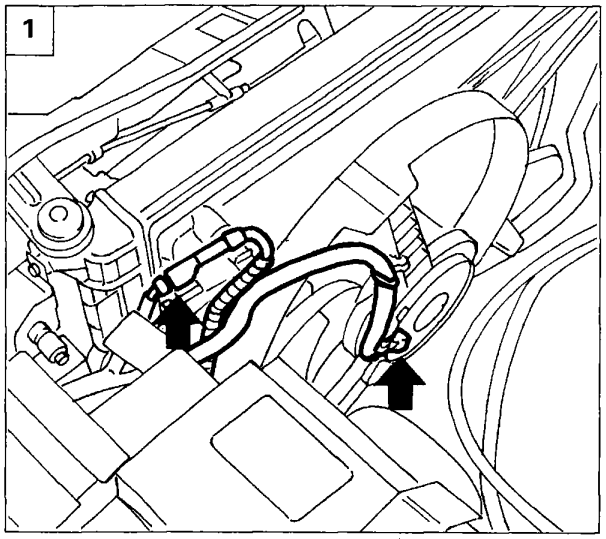
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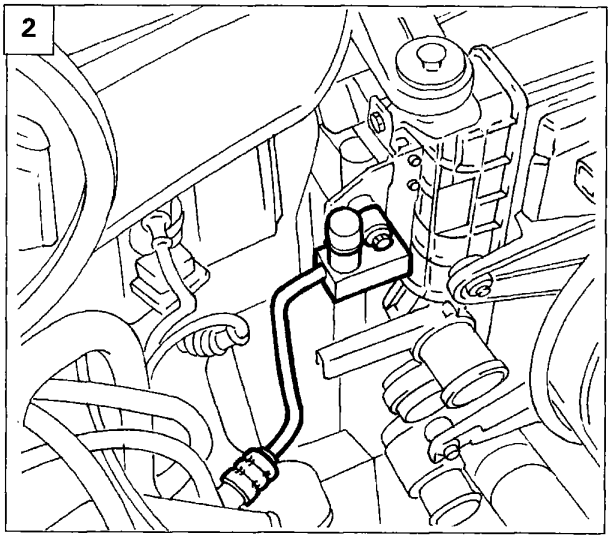
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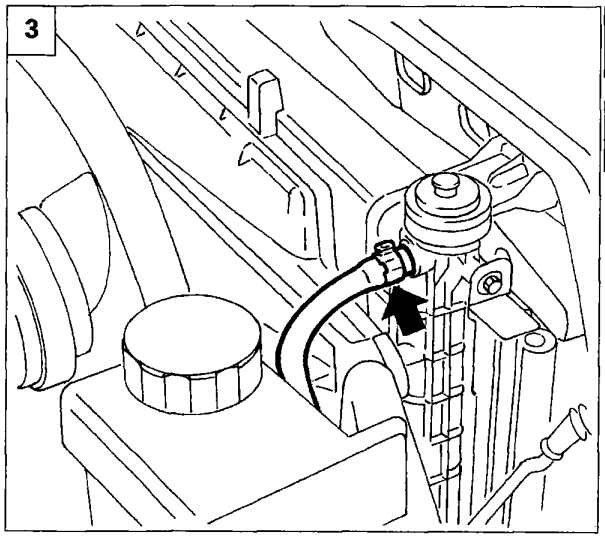
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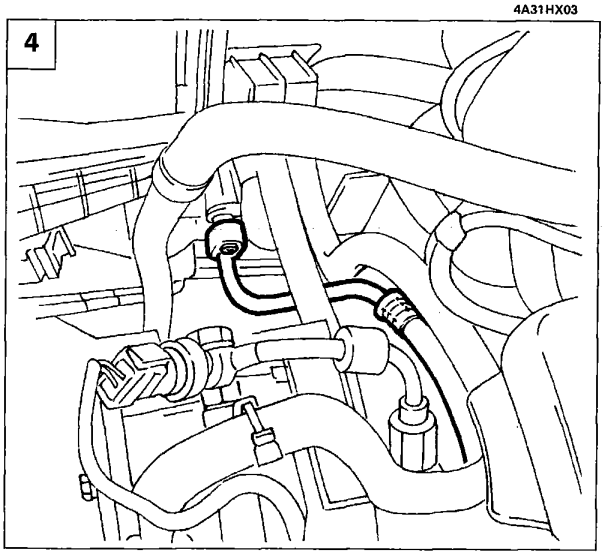



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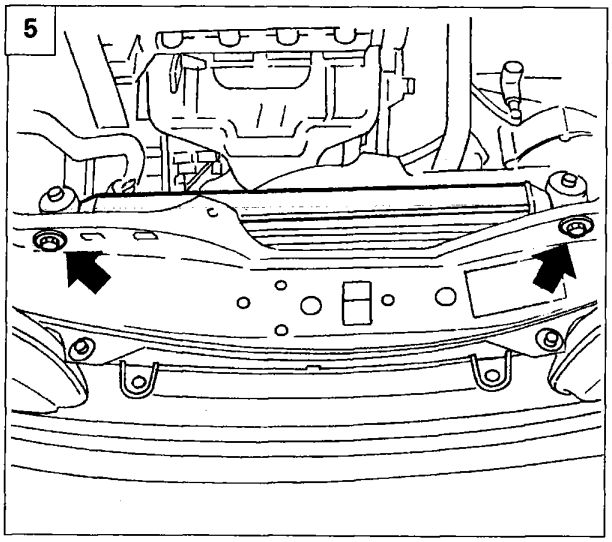



4A31HX03

1. Disconnect the engine cooling fan electrical supply connections.
2. Disconnect the high pressure air conditioning circuitn eedle valve undoing the bolt fixing it to the condenser.
3. Open the band and disconnect the pipe between the radiator and the tank.
4. Disconnect the air conditioning circuit condenser rigid inlet pipe.
5. Remove the radiator, complete with fan, undoing the two bolts fixing it to the bodyshell.




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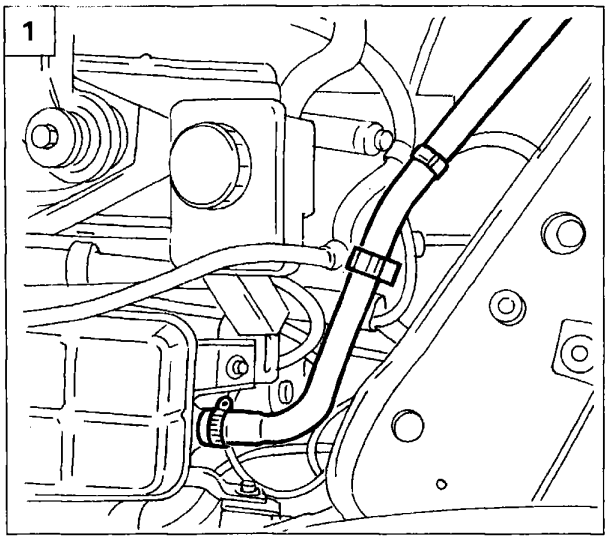



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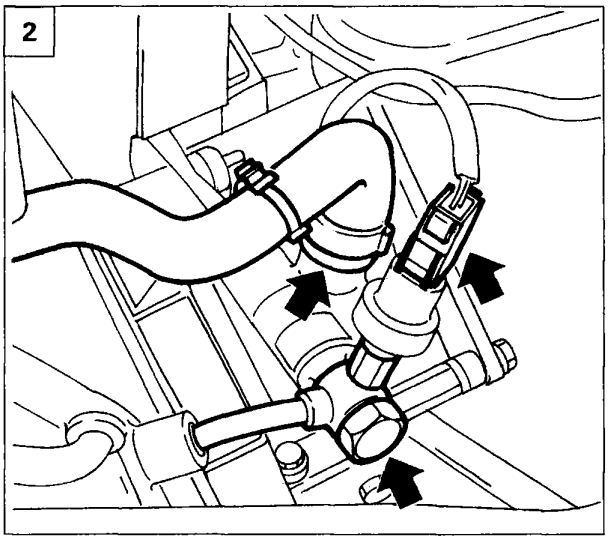


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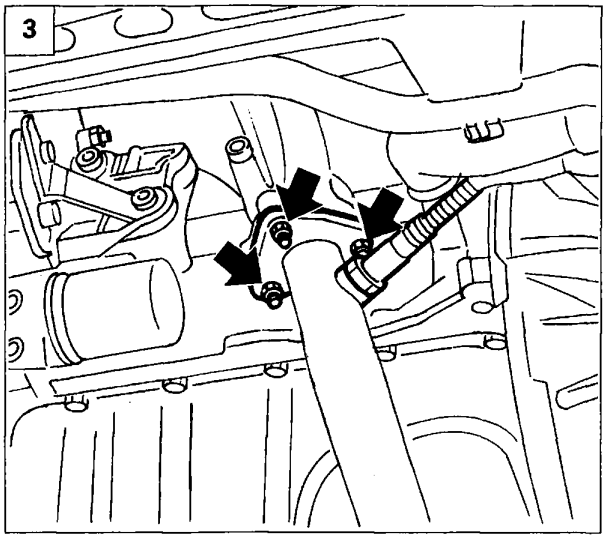
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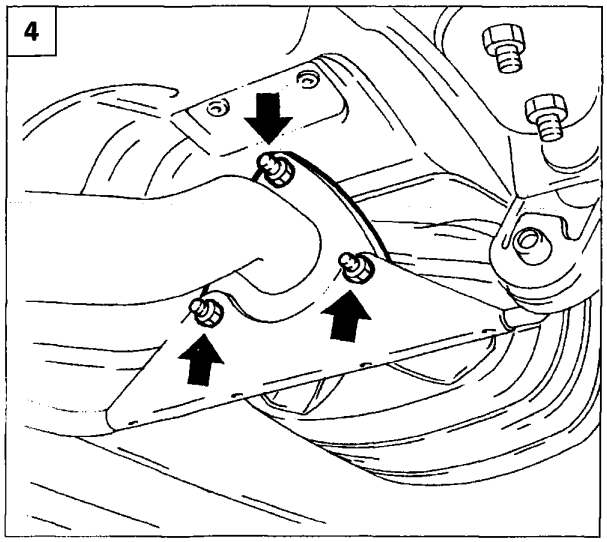

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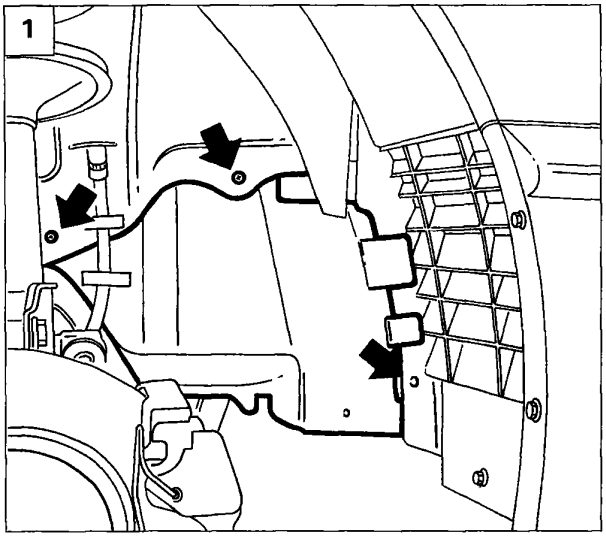



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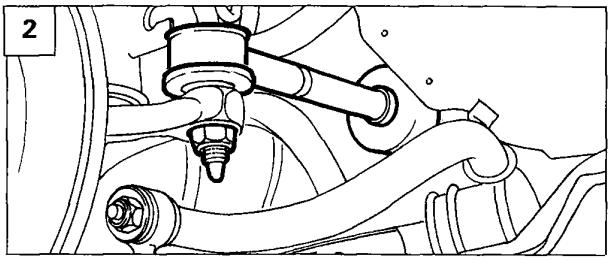
1. Disconnect the coolant pipe from the expansion tank, remove it from the retaining springs and place it at the side.
   Draw off the power assisted steering fluid from the reservoir.
2. Disconnect the electrical connection for the pressure sensor on the power assisted steering pump, undo the connector for the rigid supply pipe, open the band for the inlet pipe, then place the pipes to the side.
3. Disconnect the Lambda sensor connector and undo the nuts fixing the first section of the exhaust pipe to the manifold.
4. Undo the nuts fixing the first section of the exhaust pipe to the catalytic converter, then remove the pipe.



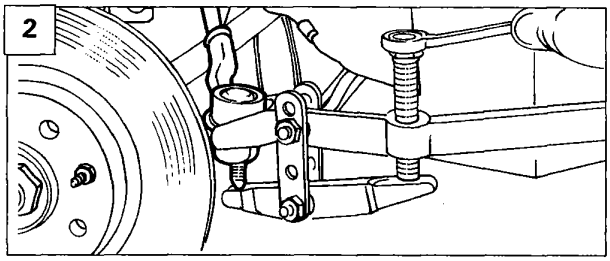
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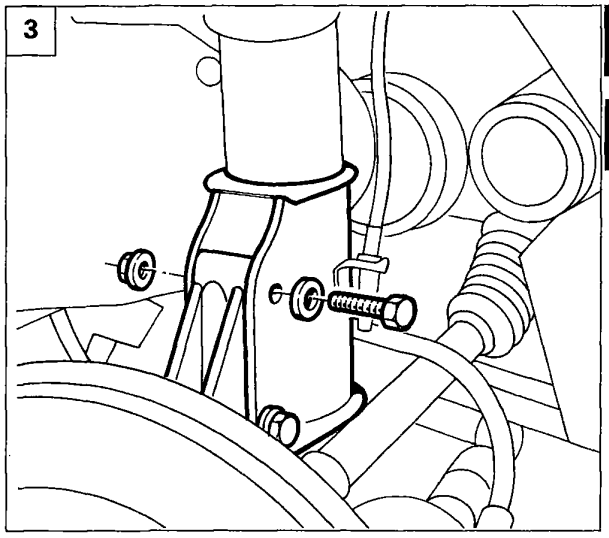

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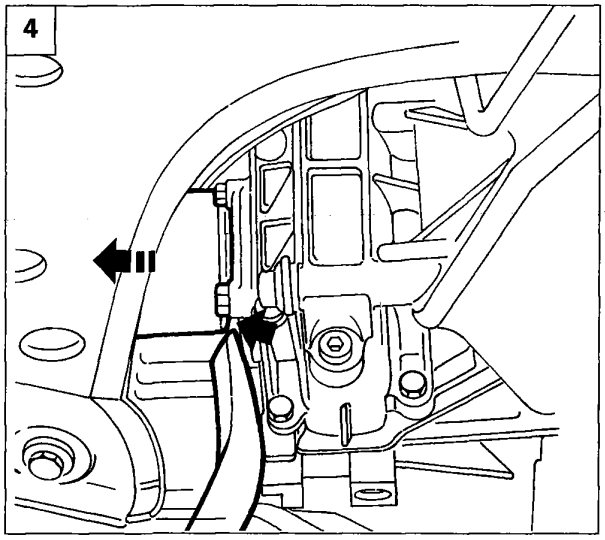



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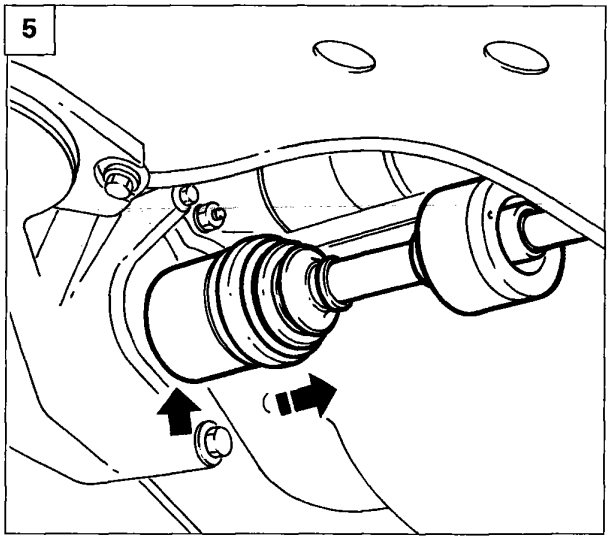



4A003B05

1. Remove the right plastic wheel arch liner acting on the fixing bolts and button.
2. Remove the nut fixing the steering track rod end to the steering knuckle (gearbox side), then extract the actual track rod end using tool 1847038000.
3. Remove the bolts fixing the shock absorber to the steering knuckle (gearbox side), then rotate the actual steering knuckle forwards, releasing the brake pipe from the housing in the shock absorber.
4. Disconnect the gearbox side driveshaft from the differential using leverage at the engagement point; positition it at the side and secure it suitably.
5. Disconnect the timing side drivehaft using suitable leverage at the engagement point; position it at the side and secure it suitably.




4A004B01

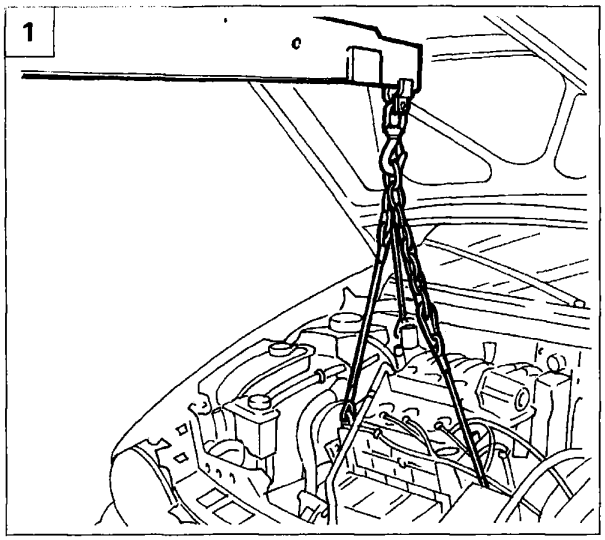



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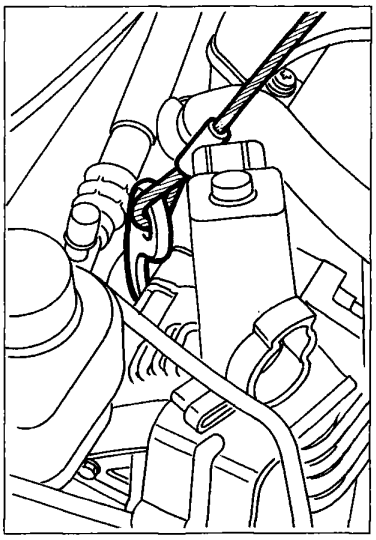
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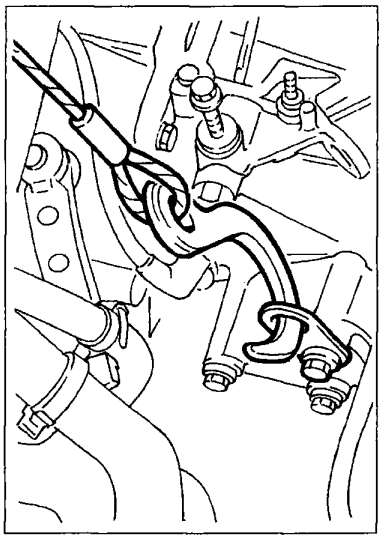

4A08HX01

1. Position the universal hoook 1860592000, fitted to a hoist, in the special power unit mounting brackets. Using the hoist, then the power unit supporting cables.

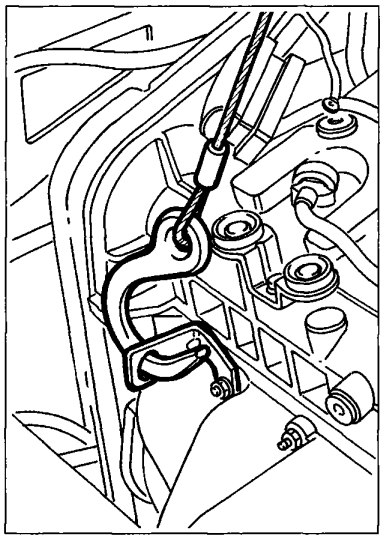
**NOTE** *The positioning of the hooks in the special power unit mounting brackets is illustrated in the diagrams below.*



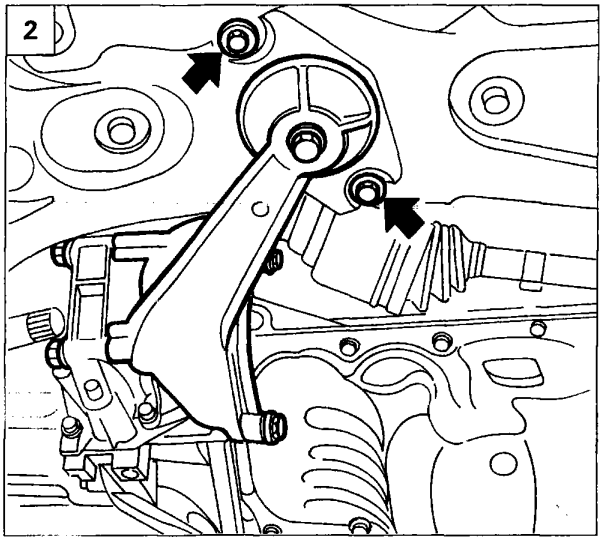
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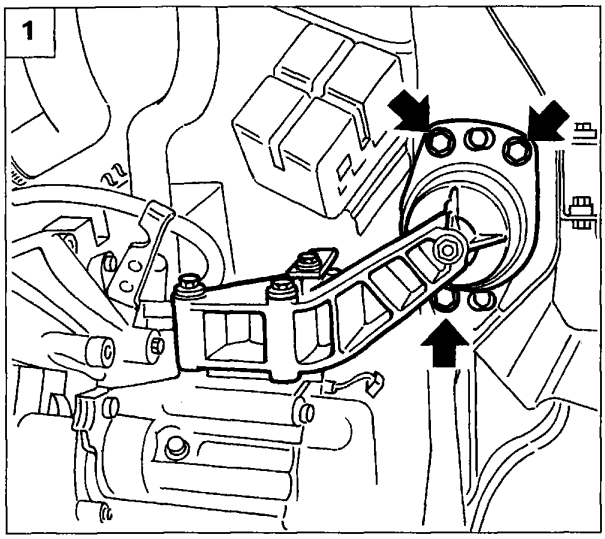



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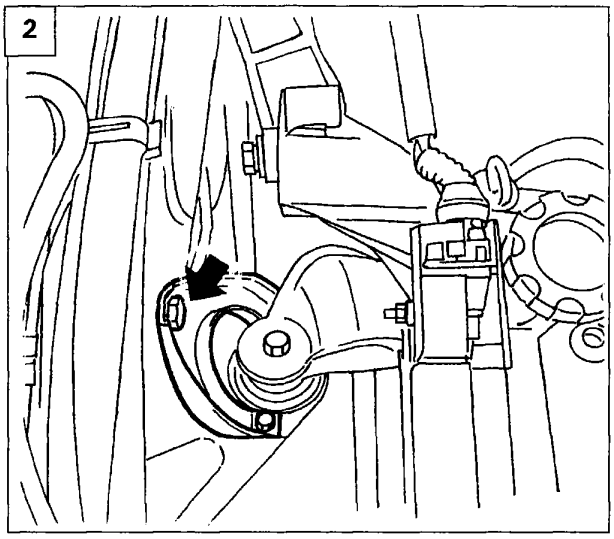
2. Undo the bolts fixing the power unit centre support to the bodyshell.



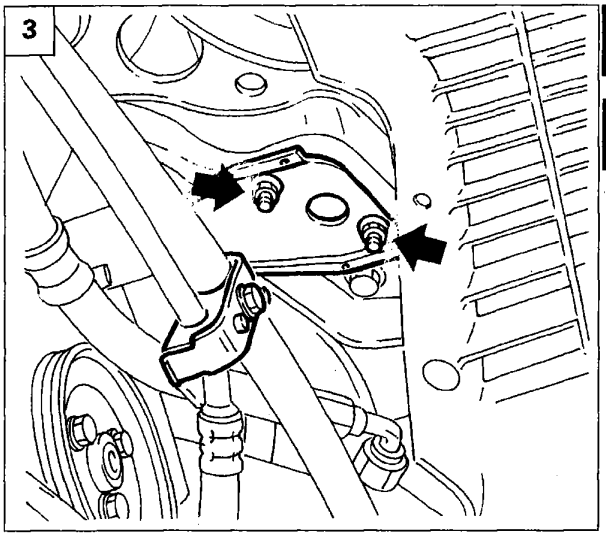
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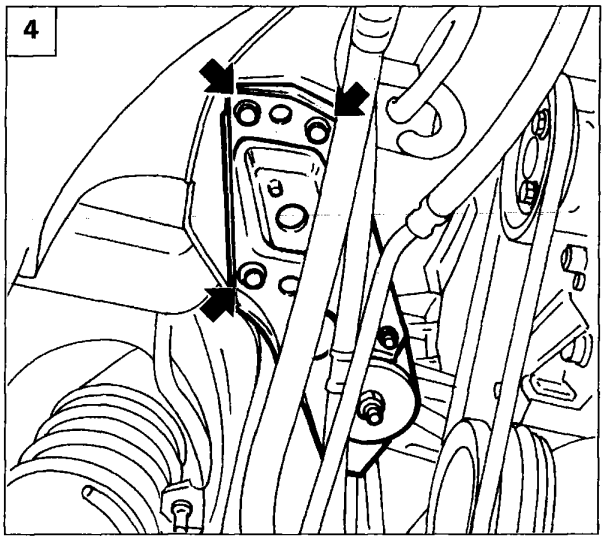



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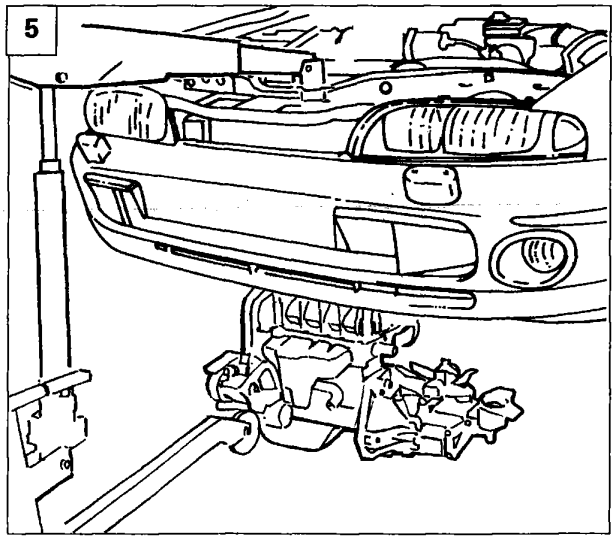



4A09HX03

1. Undo the bolts fixing the power unit support, gearbox side.
2. Undo the bolt fixing the timing side power unit mounting bracket to the bodyshell.
3. Undo the fixing nuts and place the bracket shown to the side.
4. Undo the bolts fixing the timing side power unit mounting bracket to the bodyshell.
5. Extract the power unit, from the lower part of the engine compartment, suitably manoeuvring the hoist and the lift. With the help of a second operator, rest the power unit on a support, making sure that it is in a stable position.




4A09HX04

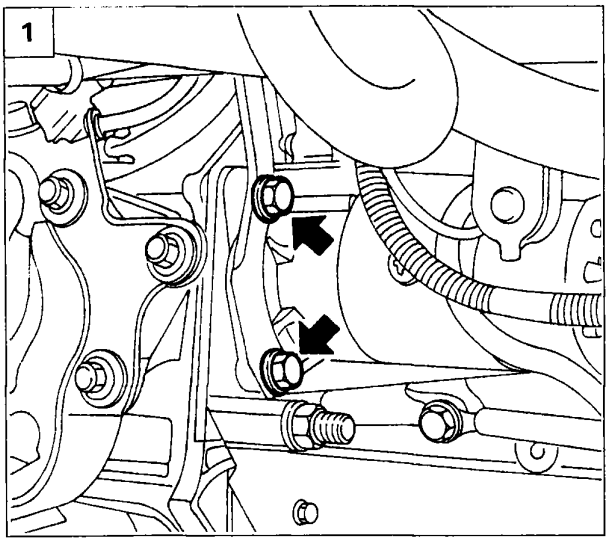



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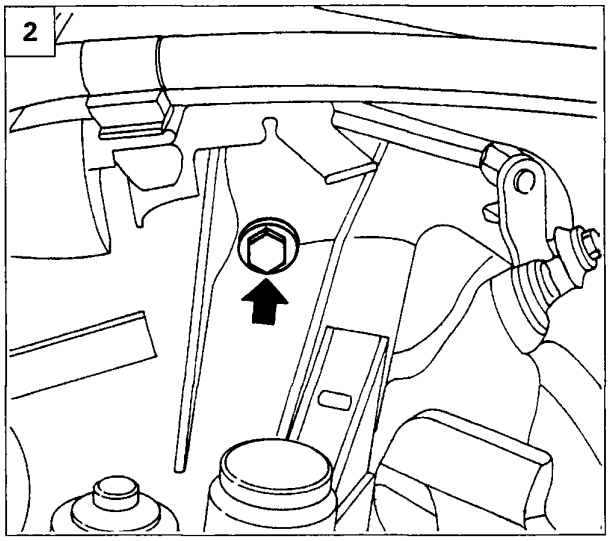


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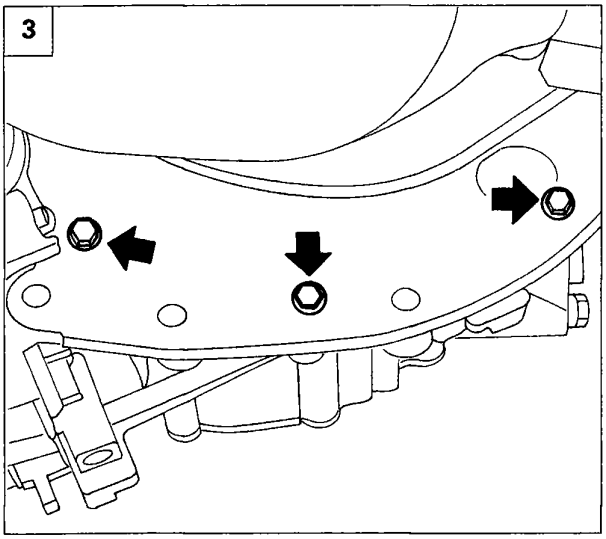
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4A10HX01



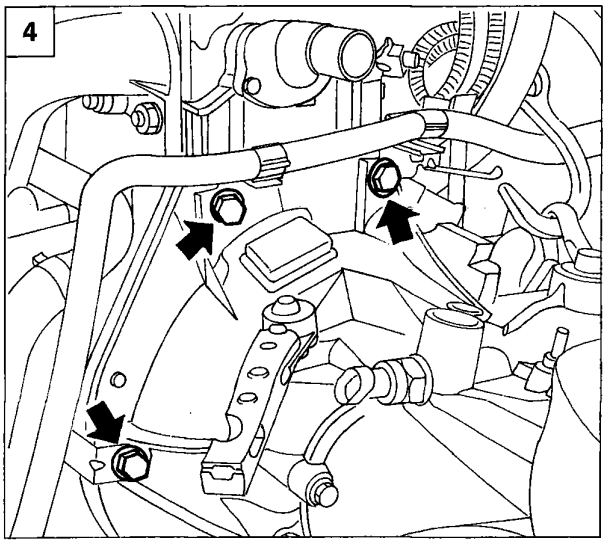

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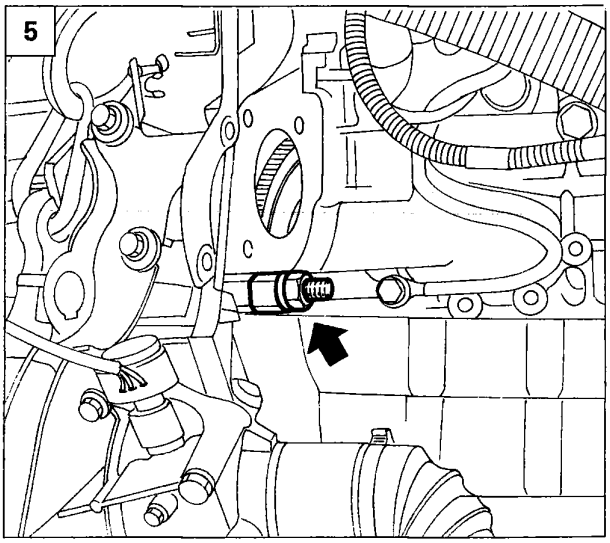

4A10HX03

## SEPARATING GEARBOX-DIFFERENTIAL UNIT

1. Disconnect the electrical connections and undo the bolts fixing the starter motor to the gearbox.
2. Undo the bolt shown in the diagram, then remove the starter motor.
3. Undo the bolts fixing the engine flywheel protection.
4. Undo the bolts fixing the gearbox-differential unit to the engine.
5. Undo the nut between the gearbox and the engine; then separate the gearbox-differential unit from the engine.




4A10HX04




4A10HX05



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**NOTE** *To refit the gearbox-differential unit to the engine, suitably reverse the order of the operations described for the removal.*
*To refit the power unit, simply reverse the order of the operations described for the removal.*

- *Prepare the engine compartment for inserting the power unit, taking care to connect all the electrical cables, pipes, etc. so that there is no possibility of interference when fitting;*
- *take care when fitting the power unit to avoid damaging the individual components;*
- *when fitting the engine coolant pipes the reference on the (rubber) pipe must coincide with the projection on the rigid hose. To refit the engine cooling circuit, refer to the instructions in the section in the "Removing-refitting radiator" chapter.*



*Once the power unit has been positioned, check that the bolts fixing the power unit support to the bodyshell are correctly tightened.*

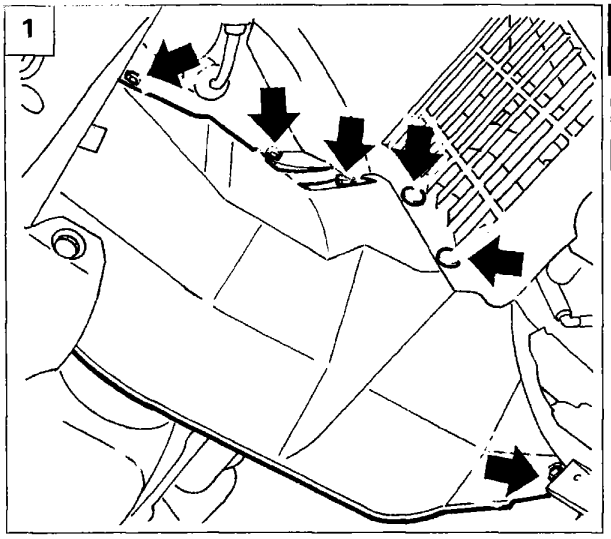


*Clutch pedal height.*

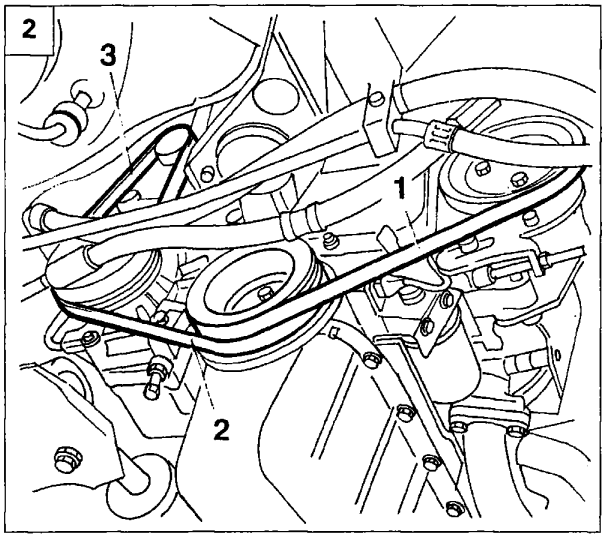


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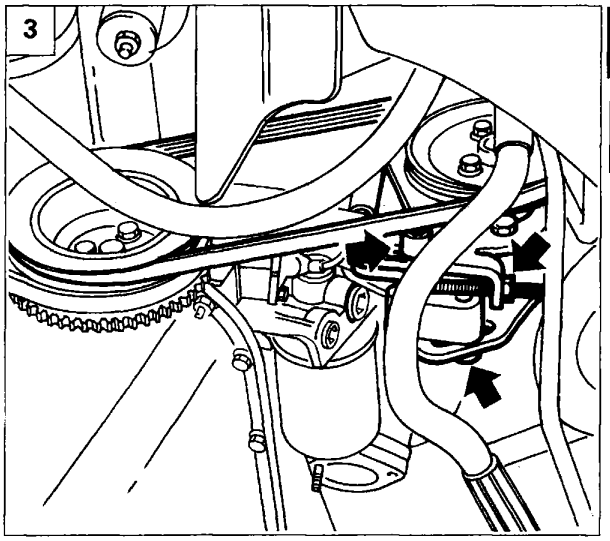
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4A12HX01




4A12HX02




4A12HX03

## REMOVING-REFITTING AUXILIARY SHAFT DRIVE BELTS

Position the vehicle on a lift, disconnect the negative battery terminal, remove the right front wheel, then proceed as described below:

1. Remove the auxiliary shaft drive belt shield.

*Check the condition and the tension of the auxiliary shaft drive belts and, in particular, make sure that there are no cracks, cuts, surface wear of the material (which would look smooth and shiny), dry or hardened sections with a consequent loss of grip. If one of the above mentioned faults is present, the belt involved must be replaced.*

2. View of auxiliary shaft drive belts fitted on vehicle:
   1. Power assisted steering pump drive belt.
   2. Air conditioning compressor drive belt.
   3. Alternator drive belt.

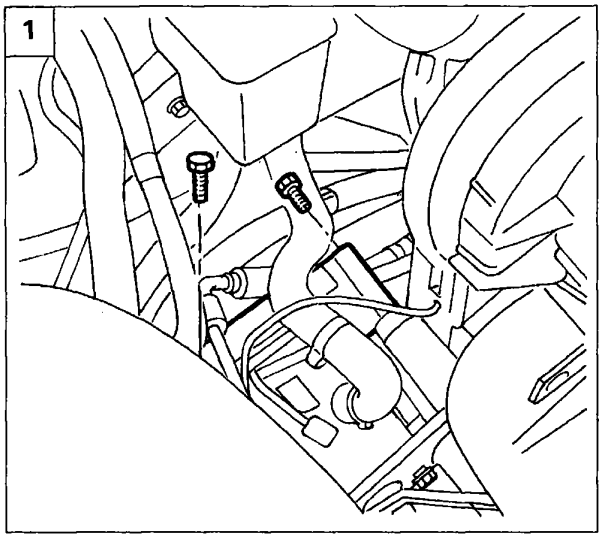
*Avoid the belts coming into contact with oil or solvents which could adversely affect the elasticity of the rubber with a consequent reduction in grip.*

**Power assisted steering pump drive belt**

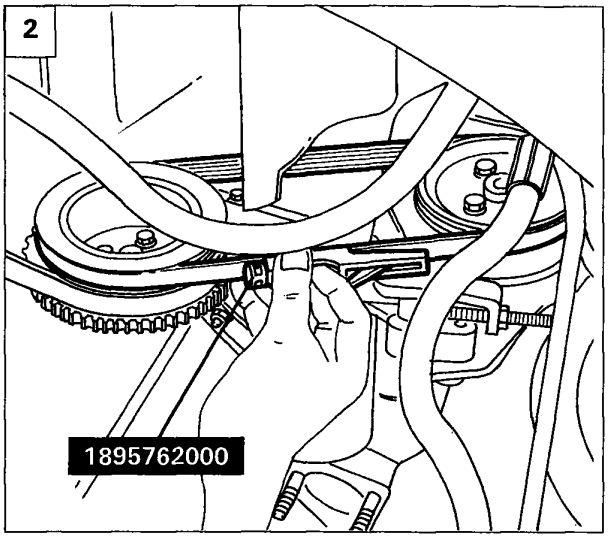
3. Loosen the tension of the power assisted steering pump drive belt, acting on the bolts shown in the diagram.



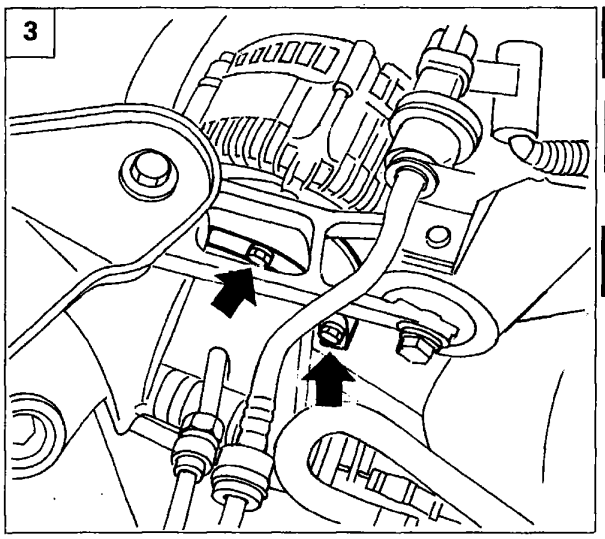
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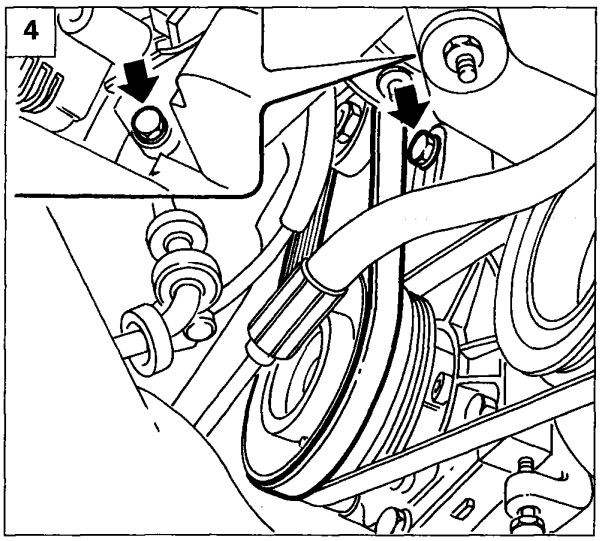

4A13HX01




4A13HX02




4A13HX03




4A13HX04

1. Remove the power assisted steering pump pulley shield, then remove the drive belt.

### Fitting

2. Tension the power assisted steering drive belt acting on the bolts securing the pump mounting bracket. Using tool 1895762000, check that the tension of the new belt is between 36-45 daN. If the same belt is re-fitted, the tension should be between 23 and 30 daN.

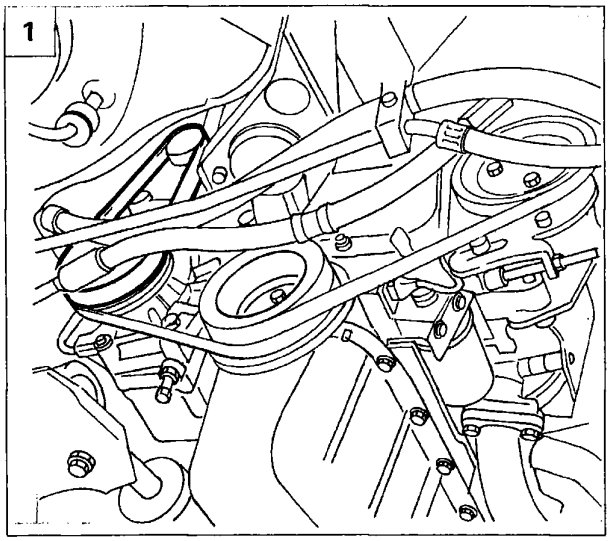
### Alternator drive belt

3. After having removed the auxiliary shaft drive belt shield, remove the alternator pulley protective cover.
4. Loosen the alternator drive belt tension, acting on the bolts shown in the diagram and on the rear bolt fixing it to the alternator bracket.

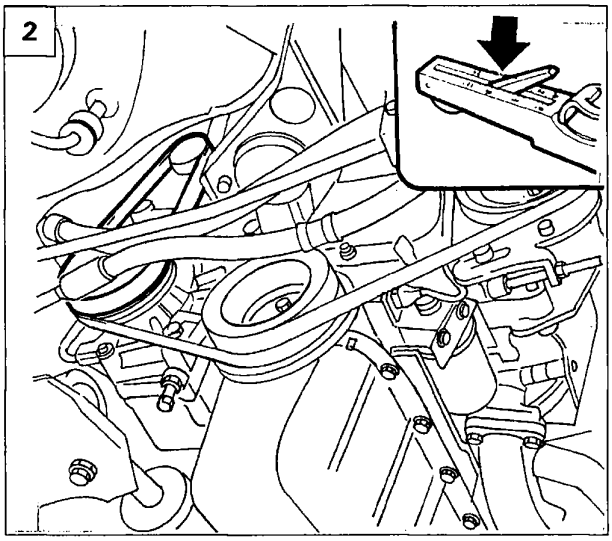


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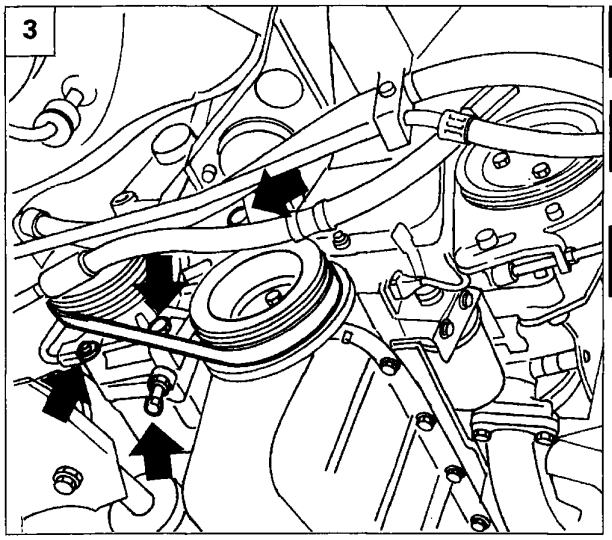
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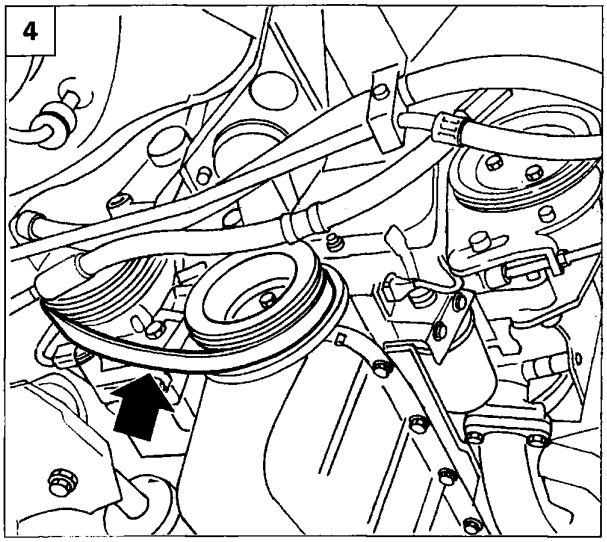

4A14HX01




4A14HX02




4A14HX03




4A14HX04

1. Remove the alternator drive belt from the drive pullies and remove it.

### Fitting

2. Position the alternator drive belt and tension it, acting on the alternator fixing bolts. Using tool 1895762000, check that the new belt tension is between 48 and 60 daN; if the same belt is refitted, check that the tension is between 30 and 41 daN. Then refit the components removed previously.

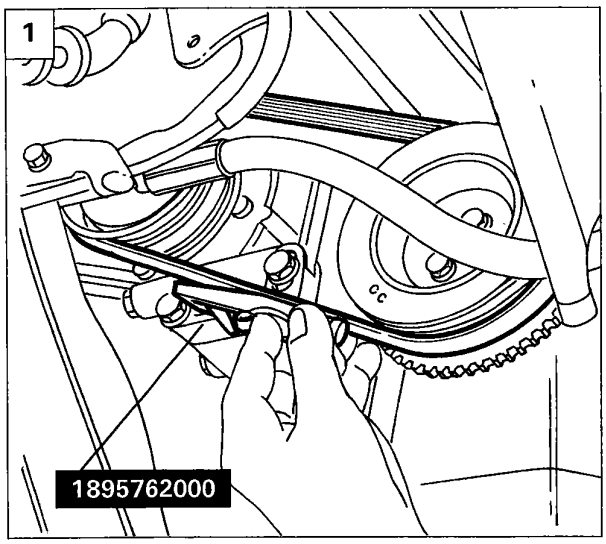
### Air conditioning compressor drive belt

After having removed the auxiliary shaft drive belt shield, remove the power assisted steering and alternator belts as described previously, then proceed as follows:

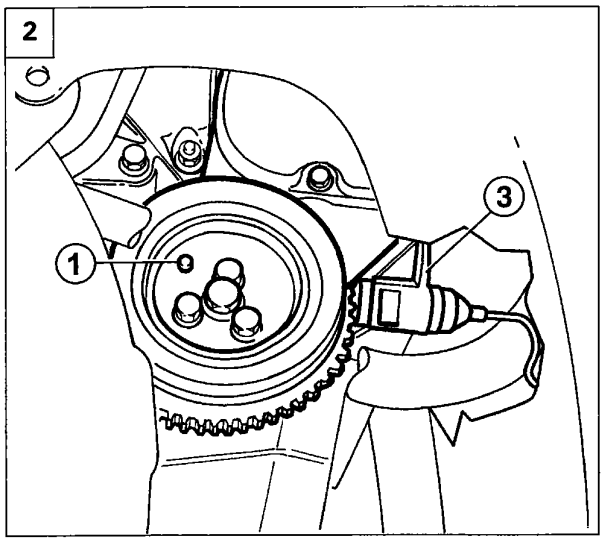
3. Loosen the air conditioning compressor drive belt tension, acting on the bolts shown in the diagram.
4. Release the compressor drive belt from the pullies and remove it.



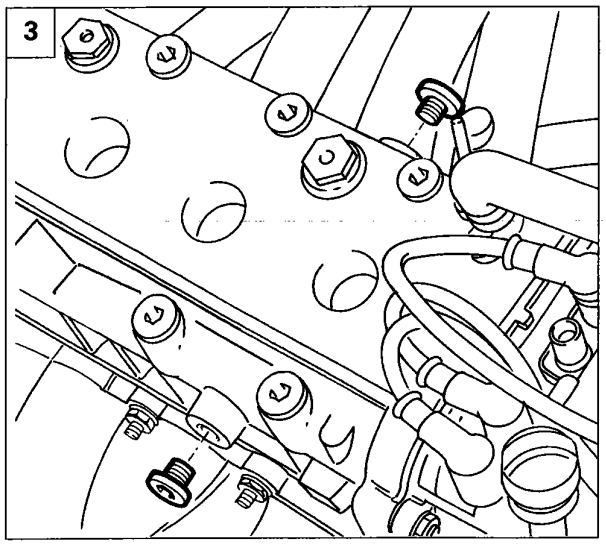
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4A15HX01



4A15HX02



4A15HX03

Fitting

1. Position the compressor drive belt on the drive pullies and tension it acting on the bolts fixing the compressor mounting bracket. Using tool 1895762000, check that the new belt tension is between 48 and 60 daN; if the same belt is refitted, the tension should be between 30 and 41 daN. Then refit the components removed previously and the alternator and power assisted steering drive belts.

## CHECKING VALVE GEAR TIMING

*Before checking the valve gear timing, the following must be removed: the auxiliary shaft drive belts, following the instructions given previously, remove the upper part of the inlet manifold and the complete fuel manifold and remove the timing belt shield, following the instructions in the next paragraph "Removing-refitting timing drive belt".*

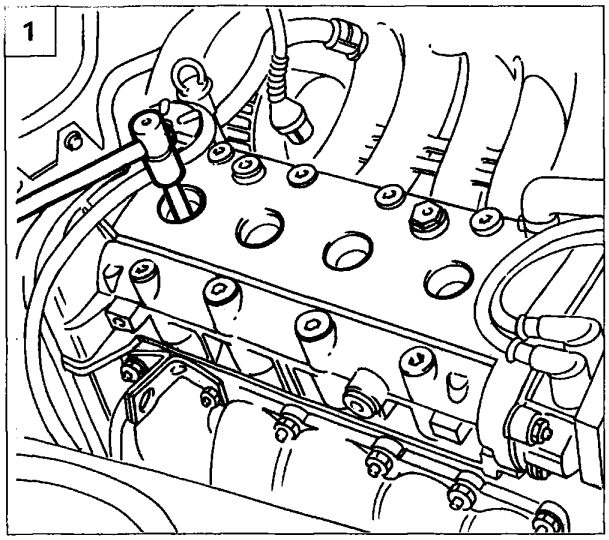
2. Rotate the auxiliary shaft drive pulley in the normal direction of rotation until the lug (1) from the opposite side is located by the rpm and TDC sensor (3). Operation to be carried out to place the pistons approximately in line with one another.

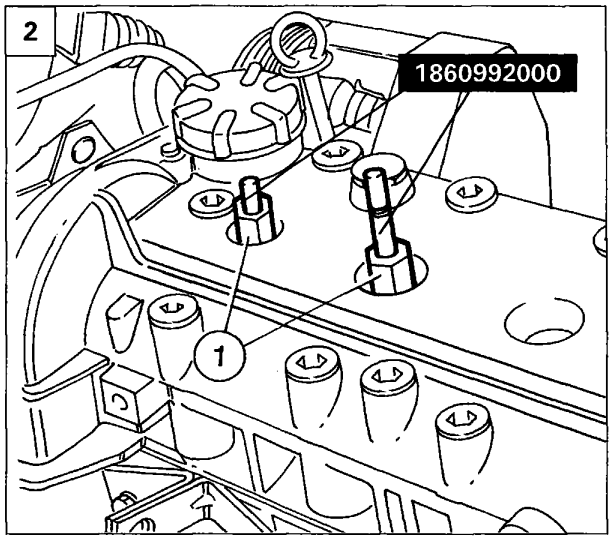
3. Remove the sealing plugs illustrated in the diagram from the camshaft housing.

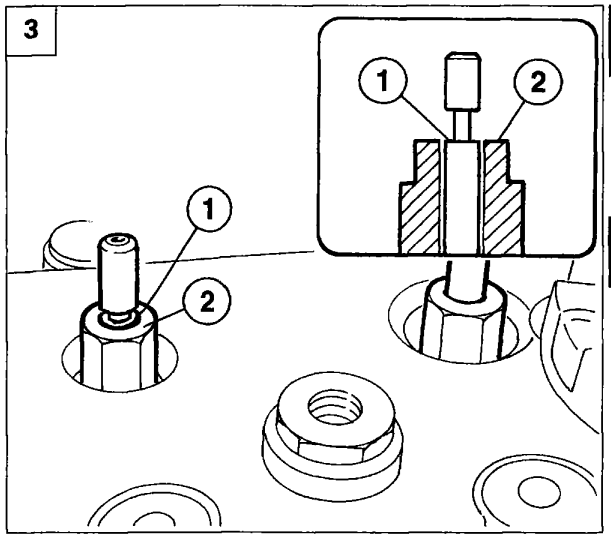
*Copyright Fiat Auto*

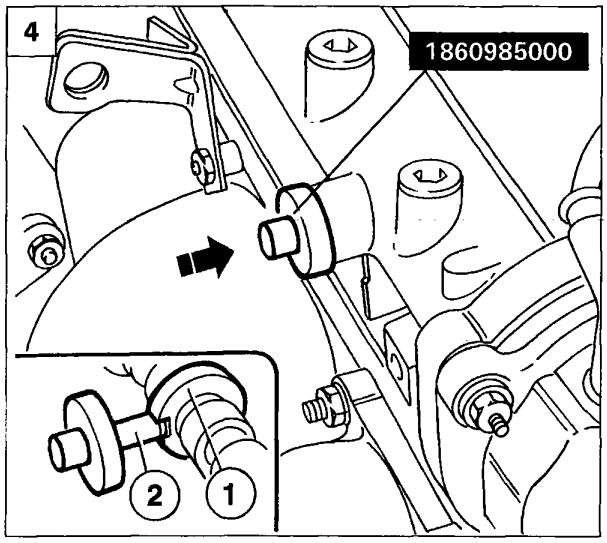

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# 10.




1. Disconnect the H.T. leads from the spark plugs and, using a USAG 279 MG spanner or similar tool, remove the spark plugs.

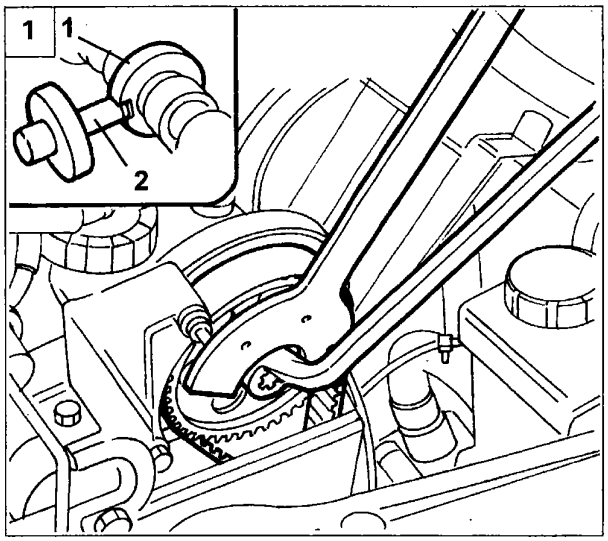
2. Position tools 1860992000 in the seats for the spark plugs for cylinders 1 and 2, tightening the tool components (1) by hand to a maximum torque of 0.5 daNm.

3. The timing is carried out with the four pistons in line, therefore in order to achieve this it is necessary to rotate the crankshaft, through its normal direction of rotation, using small movements, until the surface (1) on the moving part of the tool is in line with the plate (2) on the component fixed in the spark plug seat.
When both the tools positioned in the spark plug seats are in this condition, the engine pistons will be ine with one another with the 1st piston in the descent (intake) stroke.

4. Visually check in the plug housings that the splining (1) on the camshafts is near the actual housings, if not, rotate the crankshaft through 360°, restore the precise alignment of the pistons using tool 1860992000, then position tool 1860985000 in the actual plug housings inserting the tool pin (2) in the splining (1) on the camshafts. The engine is correctly timed under these circumstances.

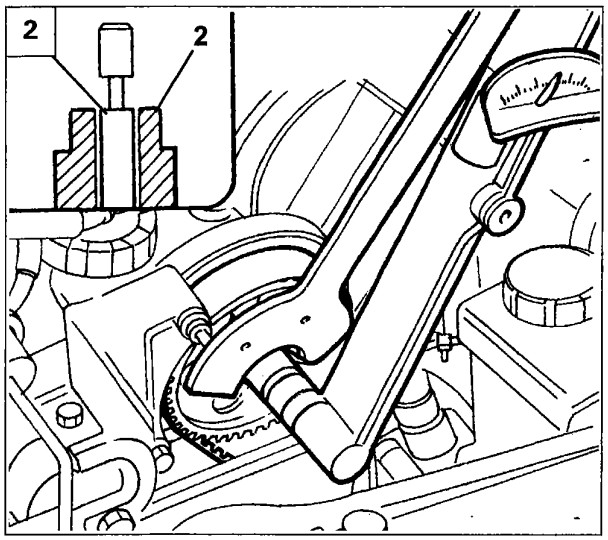


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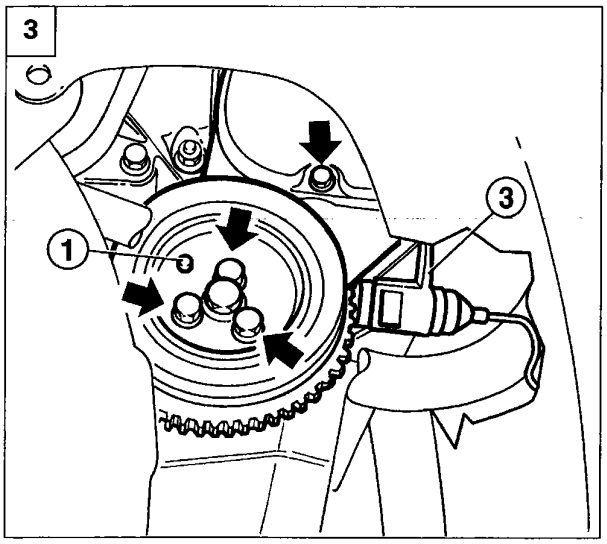

4A17HX01

1. If tools 1860985000 do not engage in the housings in the camshafts, the engine timing is not correct, therefore, the crankshaft must be rotated, using small movements, until the tools (2) are perfectly aligned with the shaft splining (1), then, using spanner 1860831000, loosen the bolt fixing the camshaft pulley.




4A17HX02

2. Rotate the crankshaft again, until tools 1860992000 indicate that the pistons are aligned, i.e. with reference (1) perfectly aligned with reference (2). The engine is correctly timed in this configuration. Tighten the timing pulley to the recommended torque and proceed with refitting the components dismantled previously.




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## REMOVING-REFITTING TIMING DRIVE BELT

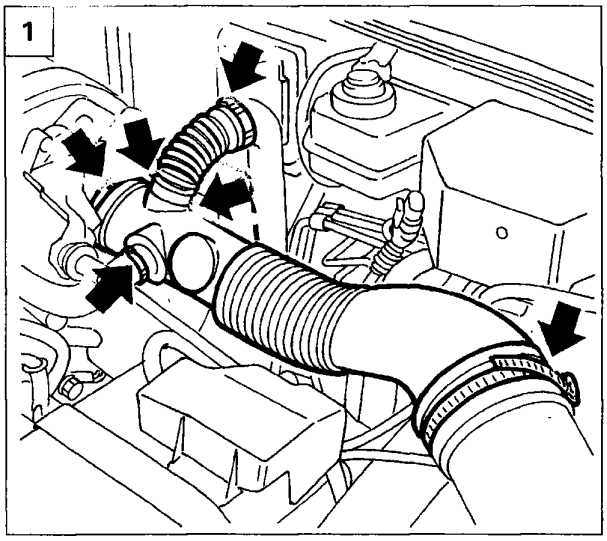
*Remove the auxiliary shaft drive belts as illustrated in the previous paragraphs.*

3. Rotate the auxiliary shaft drive pulley through its normal direction of rotation until the dowel (1) is opposite the rpm and TDC sensor (3), then undo the fixing bolts and remove it. In addition, unto the bolts for the timing belt lower shield.

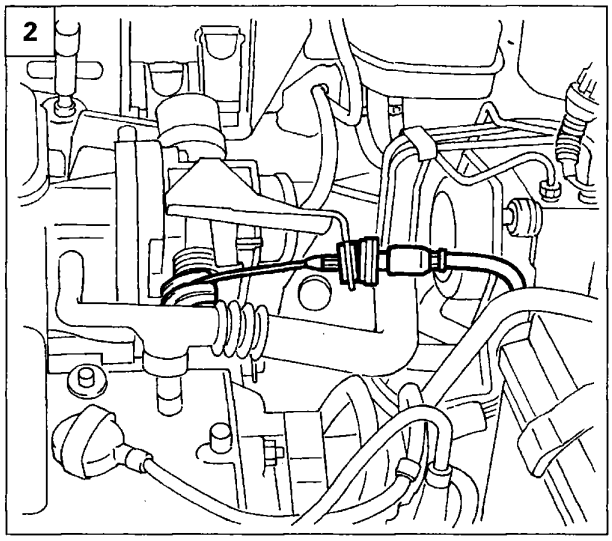


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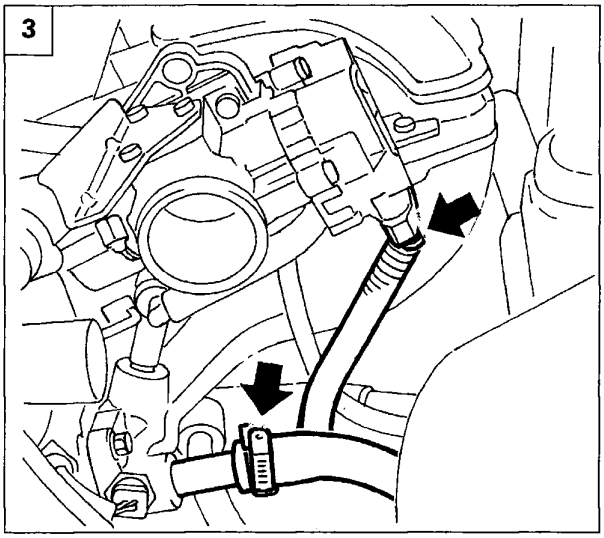
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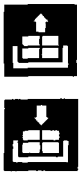

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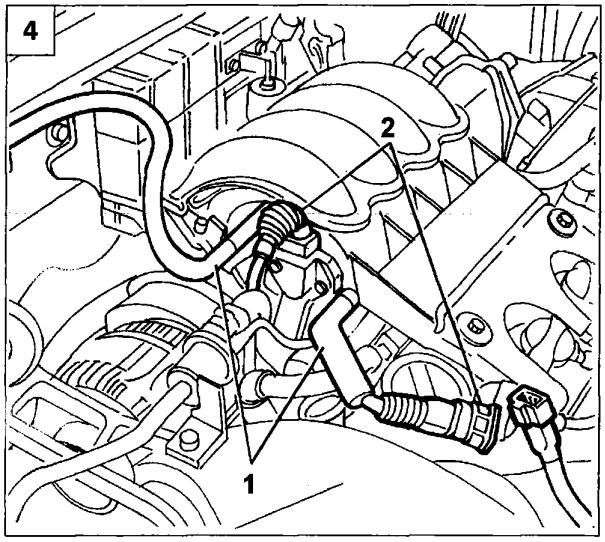

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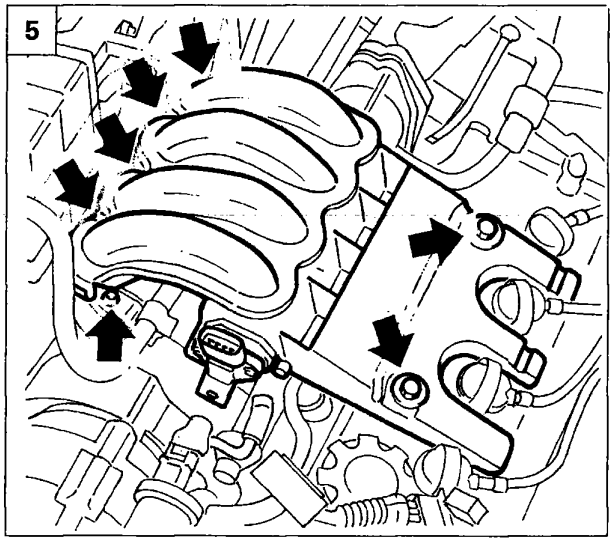

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1. Disconnect the bands illustrated and undo the bolts fixing the resonator, then disconnect the oil vapour pipe band and remove the resonator complete with hose.
2. Disconnect the accelerator cable.
3. Disconnect the connection shown and the brake servo vacuum pipe from the butterfly casing.
4. Disconnect the pipes (1) and the connections (2) from the upper part of the intake manifold.
5. Remove the fixing bolts for the upper part of the intake manifold using spanner USAG TX 27 or a similar tool and remove the manifold from the vehicle complete with butterfly casing.



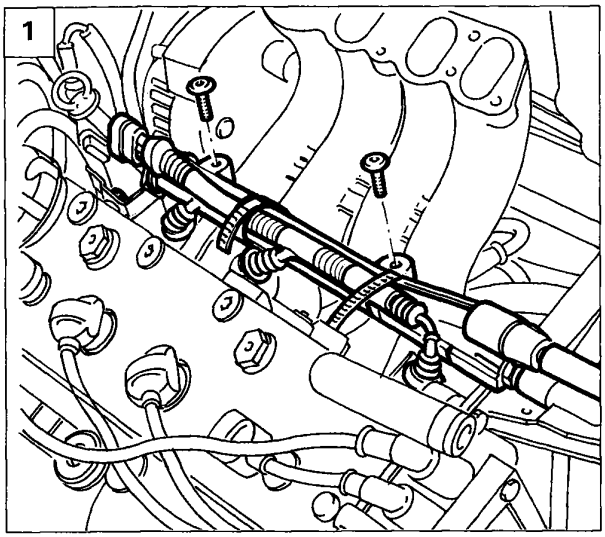

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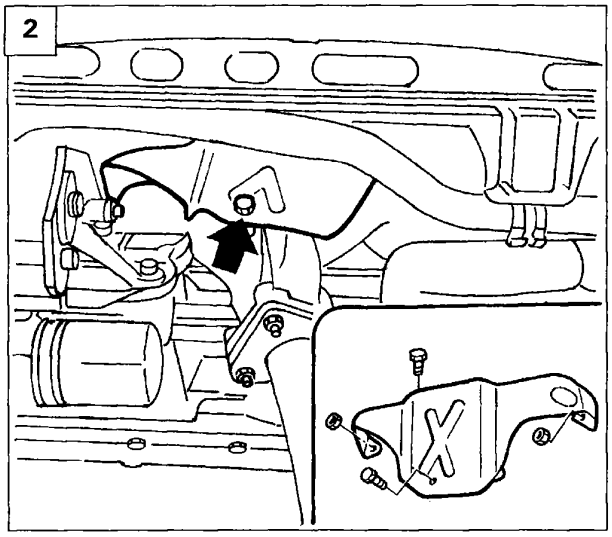


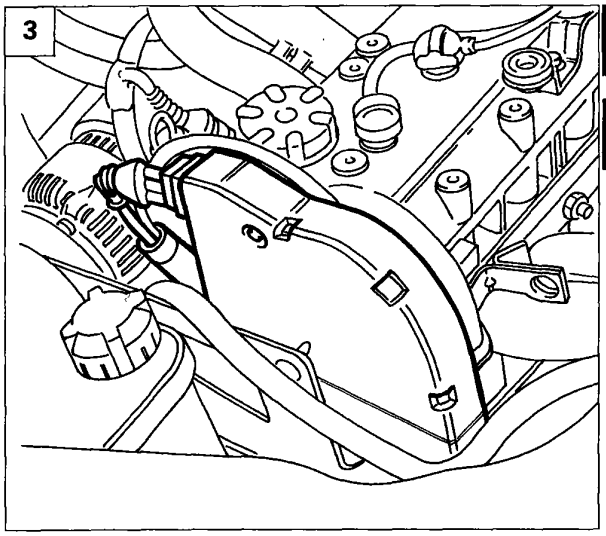

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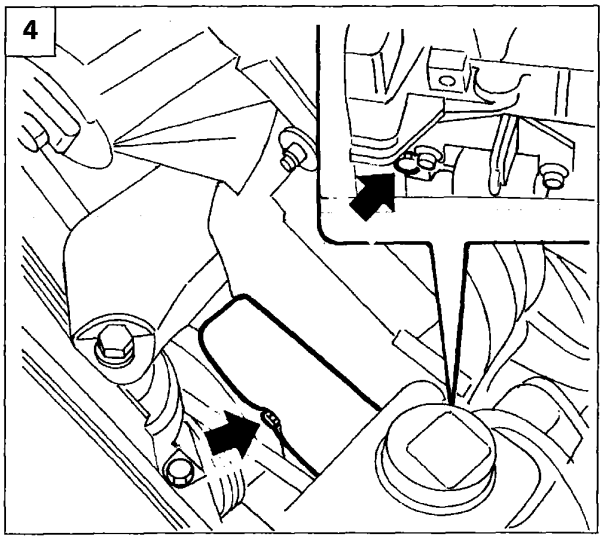
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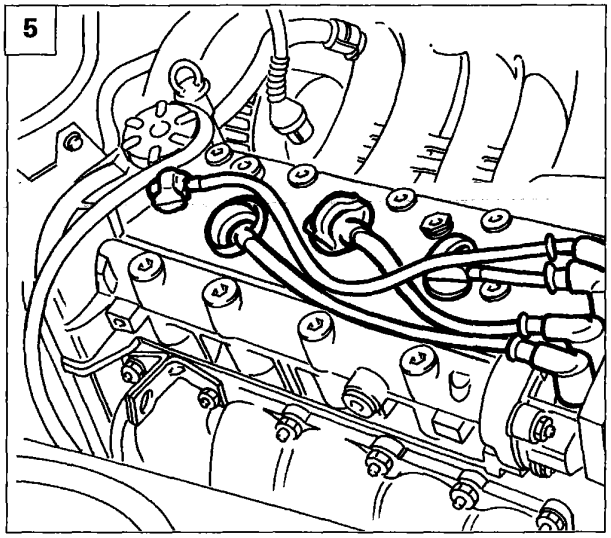



1. Undo the bolts fixing the fuel manifold, remove it complete with injectors and place it to the side away from the working area.
2. Remove the heat shield, undoing the fixing nuts and bolts.
3. Undo the bolts fixing the upper timing belt shield; disconnect the connector for the rpm and TDC sensor, then remove the upper shield.
4. Undo the fixing bolts and remove the lower shield for the timing drive belt.
5. Disconnect the H.T. leads from the spark plugs.

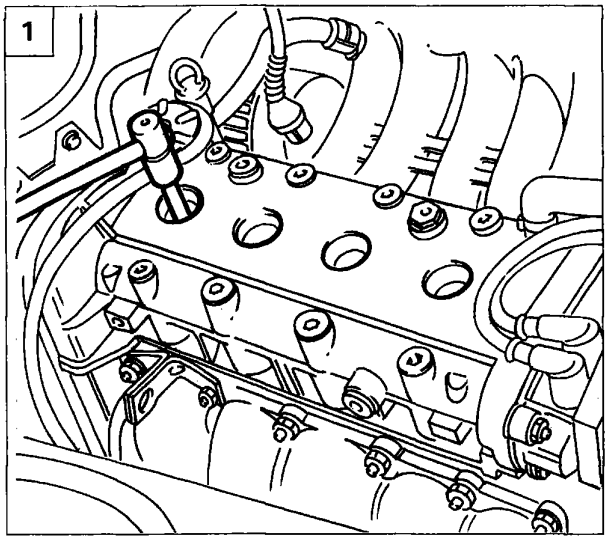


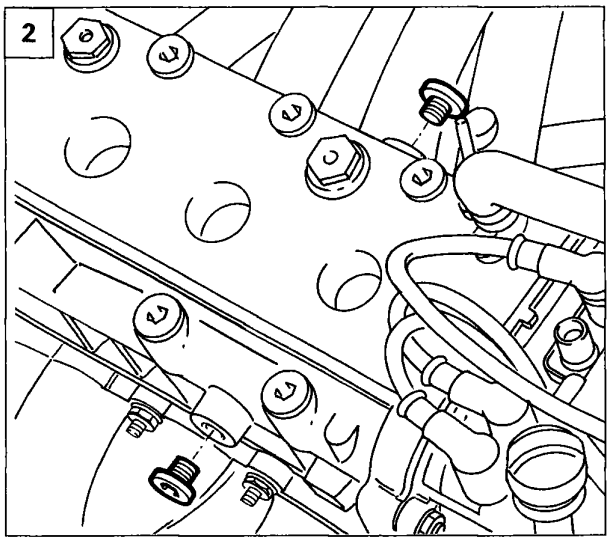



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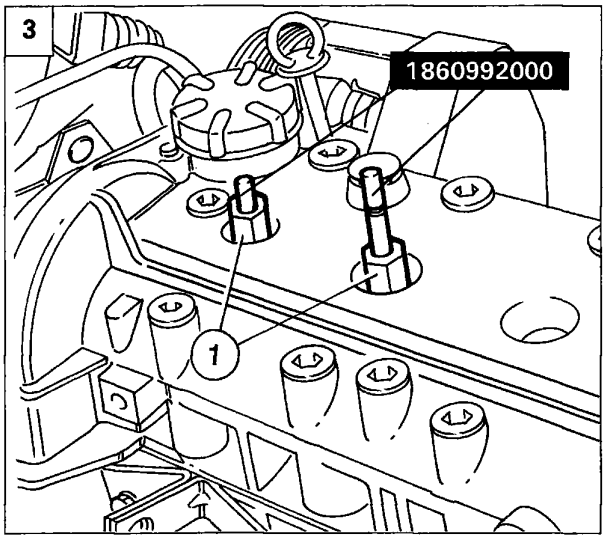
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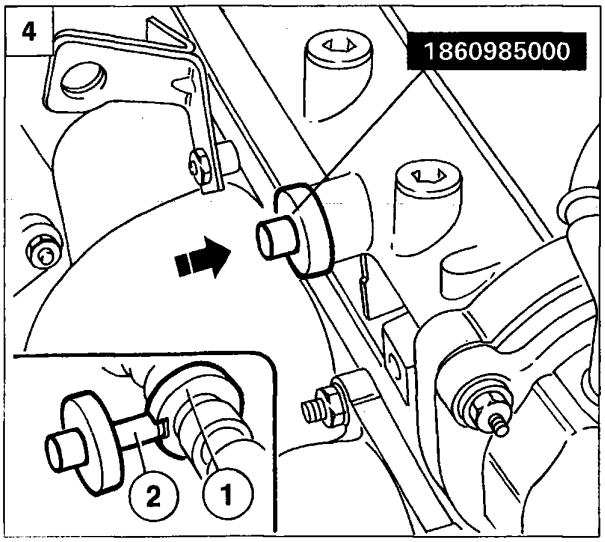

4A16HX01




4A15HX03




4A16HX02




4A16HX04

1. Remove the spark plugs using spanner USAG 279 MG or a similar spanner.

2. Remove the two sealing plugs, illustrated in the diagram, from the camshaft housing.

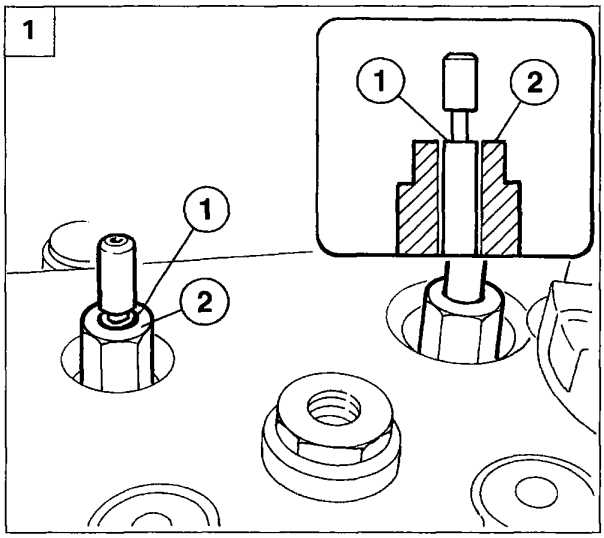
3. Position the tools 1860992000 in the housings for the spark plugs for cylinders 1 and 2, tightening the tool components (1) by hand to a maximum torque of 0.5 daNm.

4. Visually check the plug seats to ensure that the splining (1) on the camshafts is near the actual seats, if not, rotate the crankshaft through 360°, restore the precise alignment of the pistons, using tools 180992000, then position tools 1860985000 in the actual plug housings; insert the tool pin (2) in the splining (1) on the camshafts. The engine is correctly timed under these circumstances.

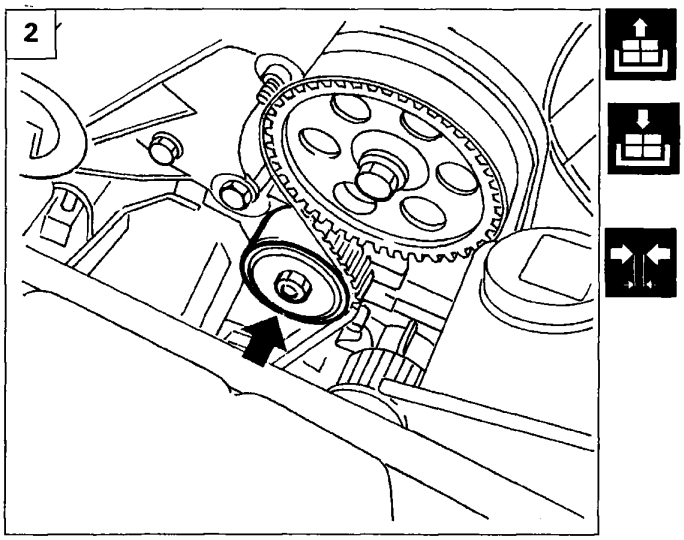
*Tools 1860985000 can be used as reaction tools to loosen the bolts fixing the camshaft rear gears (if repairs have to be carried out on them)*



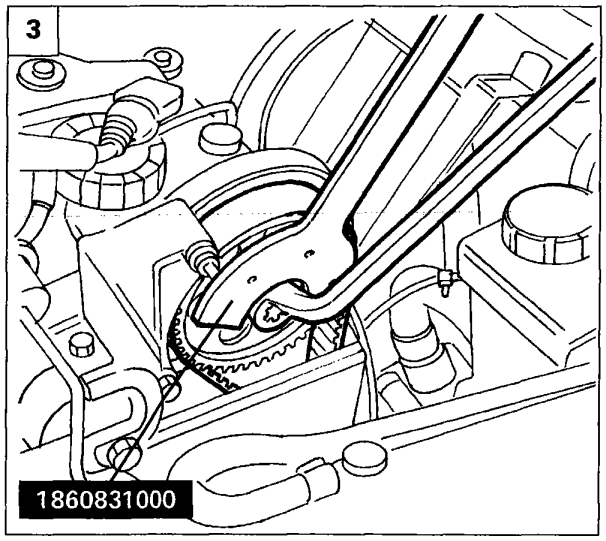
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4A16HX03




4A21HX02




4A21HX03

1. The timing is carried out with the four pistons in line, therefore the crankshaft has to be rotated until the reference (1) on the moving part of the tool is in line with the reference (2) on the fixed component in the spark plug housing.

   When both tools positioned in the spark plug housings are in this condition the pistons will be in line with one another with piston no. 1 in the descent (intake) stroke.

**NOTE** *The pistons are also aligned at 180° from the correct position. Once the pistons are aligned, check that the pin on the crankshaft gear is approximately opposite the rpm and TDC sensor.*

2. Loosen the nut fixing the timing belt tensioner, then remove the actual belt.

**Fitting and tensioning timing drive belt**

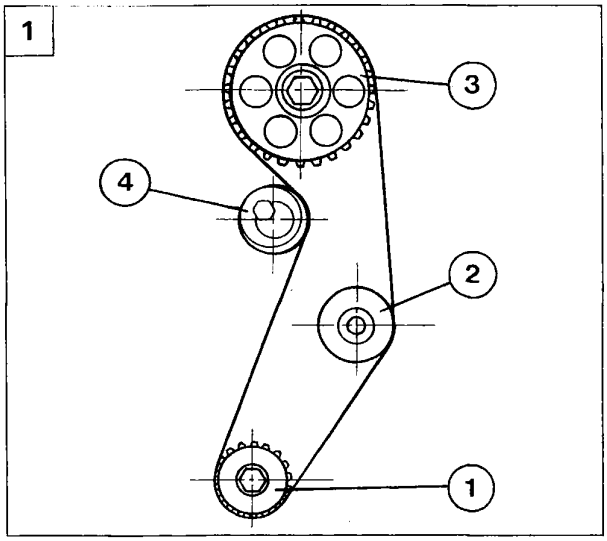
3. The camshaft drive pulley has slots; to facilitate the correct matching between the pulley teeth and the timing belt, loosen the bolts fixing the actual pulley using tool 1860831000.



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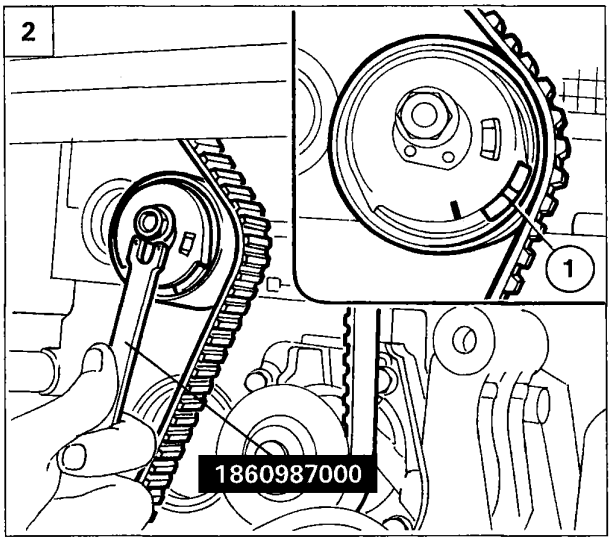
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1



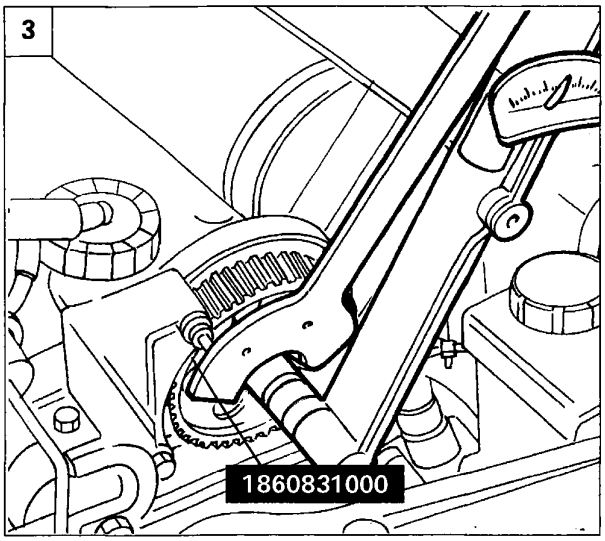

4A22HX01

2



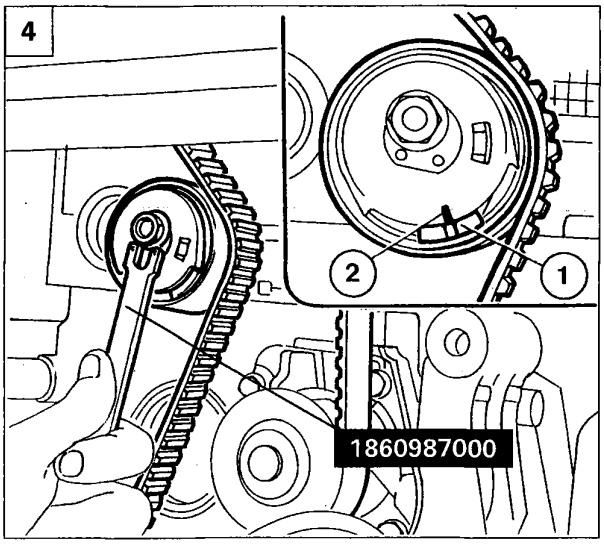

4A22HX02

3




4A22HX03

4




4A22HX04

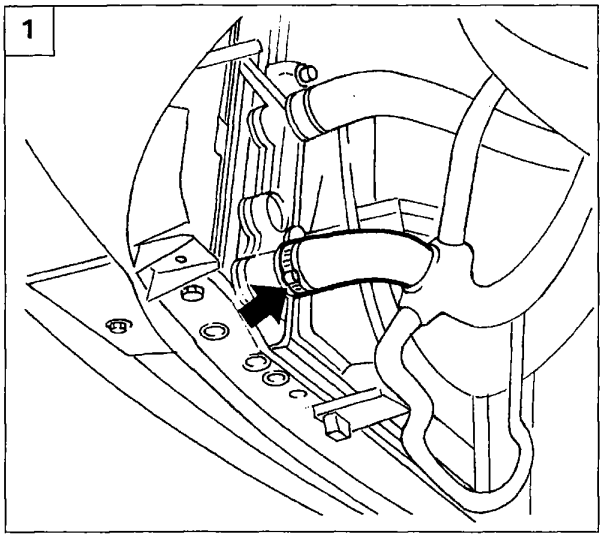
1. Before fitting the timing belt, make sure that the camshafts are timed and secured using tools 1860985000 and that the pistons are aligned checking the position of the pins for tool 1860992000 as described previously. Then fit the timing drive belt, following the order given below:
   1. Crankshaft drive gear
   2. Water pump gear
   3. Timing drive pulley
   4. Belt tensioner pulley
2. Position tool 1860987000 and place the automatic tensioner in the maximum tension position, i.e. with the moving reference (1) positioned as illustrated, then lock the nut fixing the tensioner to the support.
3. Using spanner 1860831000, tighten the inlet side timing pulley to the recommended torque. Remove the tools positioned previously for timing and locking the camshafts and rotate the crankshaft through two revolutions in its normal direction of rotation.
4. Loosen the tensioner fixing nut and make sure that the moving reference on the tensioner (1) coincides with the fixed reference (2), then tighten the tensioner fixing nut to the recommended torque. Rotate the crankshaft through two revolutions in its normal direction of rotation, then reposition the tools for timing the engine illustrated previously and check that the engine timing is correct.

*Fit the remaining components, reversing the order of the operations described for the removal.*

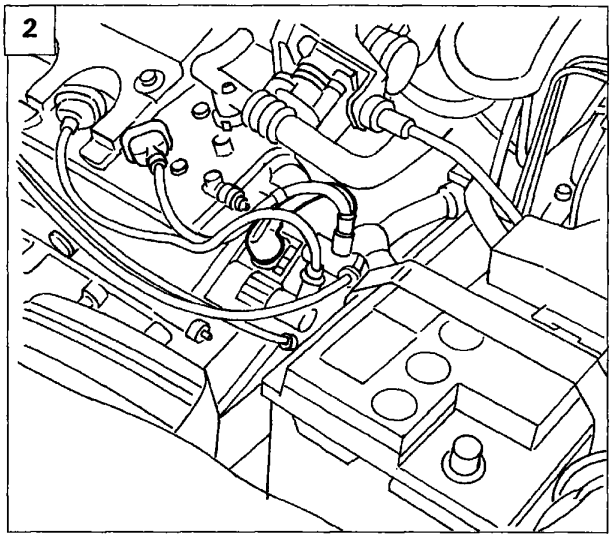
Before refitting the timing belt, make sure that the camshafts are correctly timed and locked using tools 1860985000 and that the pistons are aligned, checking the position of the pins for tool 1860992000 as described previously. Then fit the timing drive belt following the order given below:



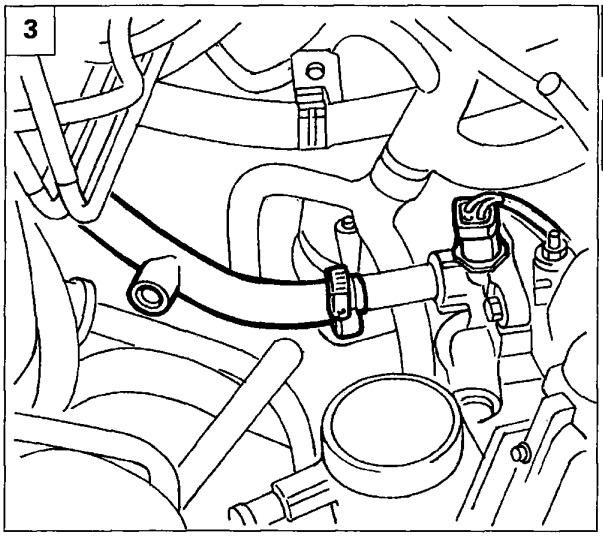
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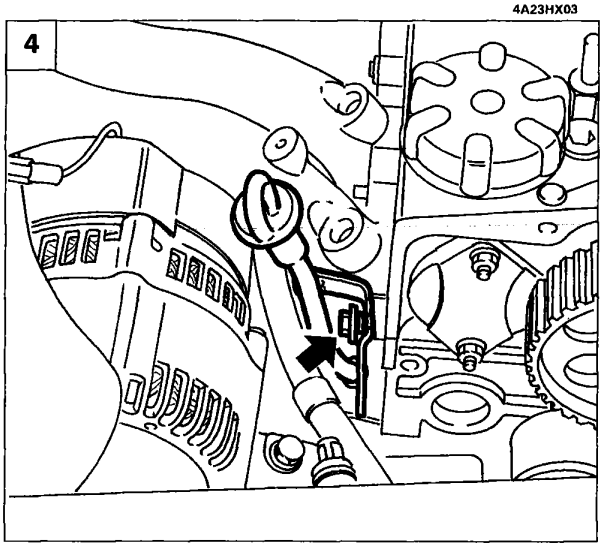

4A23HX01




4A23HX02




4A23HX03




4A23HX04

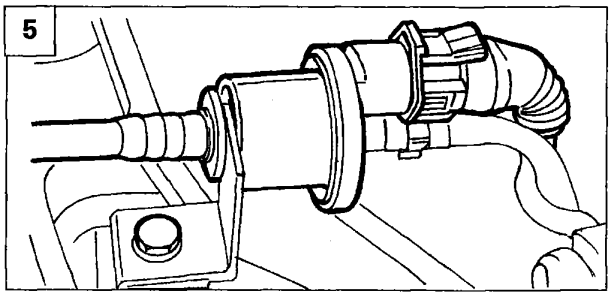
## REMOVING-REFITTING CYLINDER HEAD

Position the vehicle on a lift, disconnect the negative battery lead, then proceed as described below:

1. Drain the engine coolant, disconnecting the hose shown in the diagram from the lower part of the vehicle

*Remove the timing drive belt, following the instructions given in the previous paragraph.*

2. Disconnect the connections (1), then remove the ignition coils acting on the fixing nuts and the engine cooling system pipe underneath.
3. Disconnect the outlet pipe from the heater and the water temperature sensor connection (1).
4. Undo the bolt fixing the engine oil dipstick retaining bracket to the cylinder head.
5. Disconnect the fuel vapour solenoid valve connection and undo the mounting bracket fixing bolt.

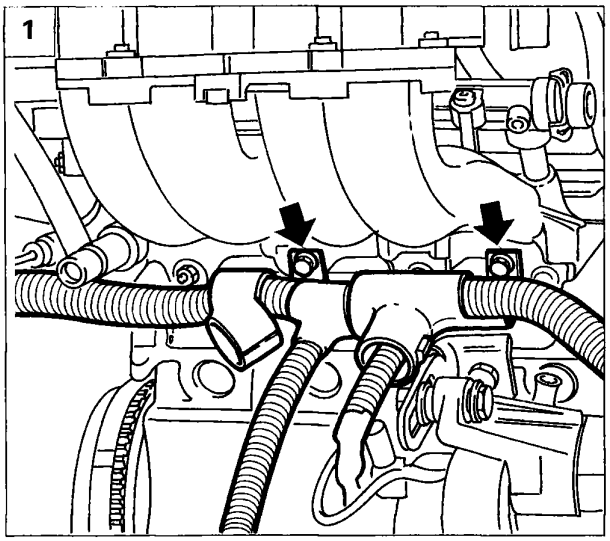



4A23HX05

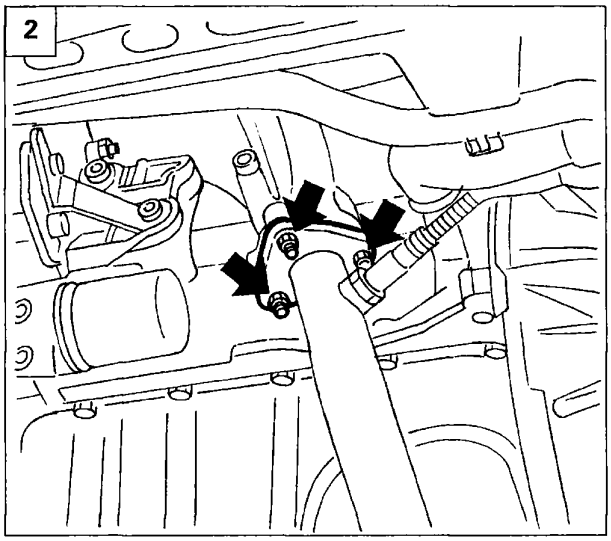


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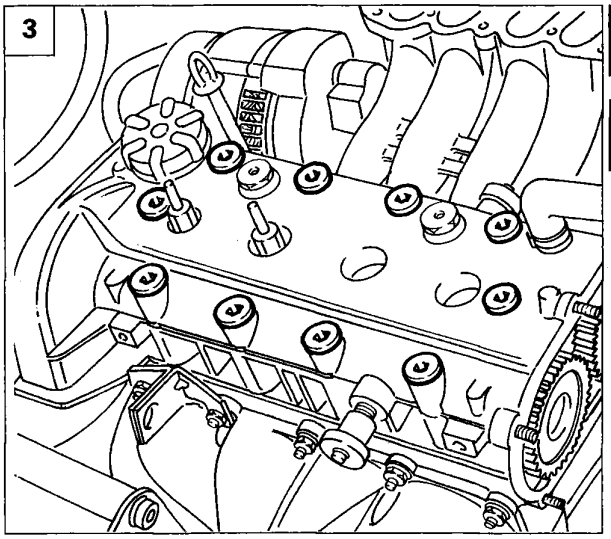
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4A24HX01

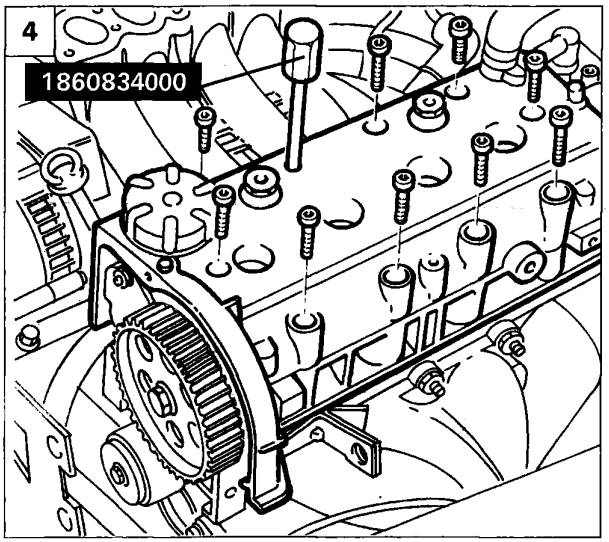


4A24HX02

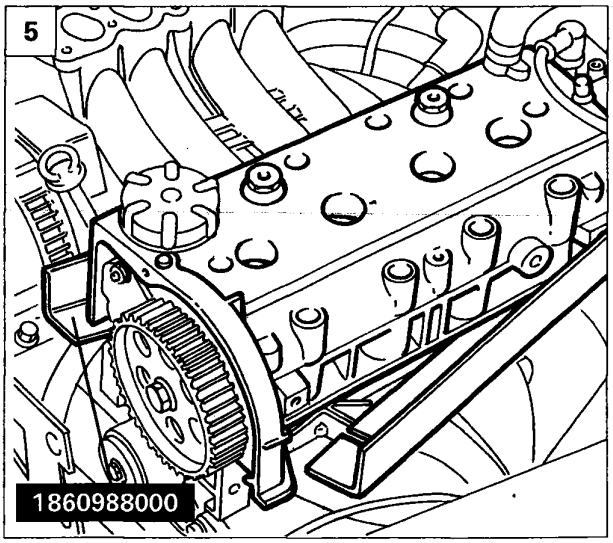


4A24HX03

1. Release the injection cables from the lower part of the intake manifold, undoing the mounting bracket fixing bolts.
2. Undo the nuts fixing the first section of the exhaust pipe to the manifold.
3. Undo the protective plugs for the bolts fixing the camshaft housing to the cylinder head. Also remove the component (1).
4. Using spanner 1860834000, undo the bolts fixing the camshaft housing to the cylinder head.
5. Raise the head, as necessary, and position the pair of tools 1860988000 for retaining the tappets, then remove the camshaft housing from the cylinder head, tools 1860992000 and the camshaft housing gasket.



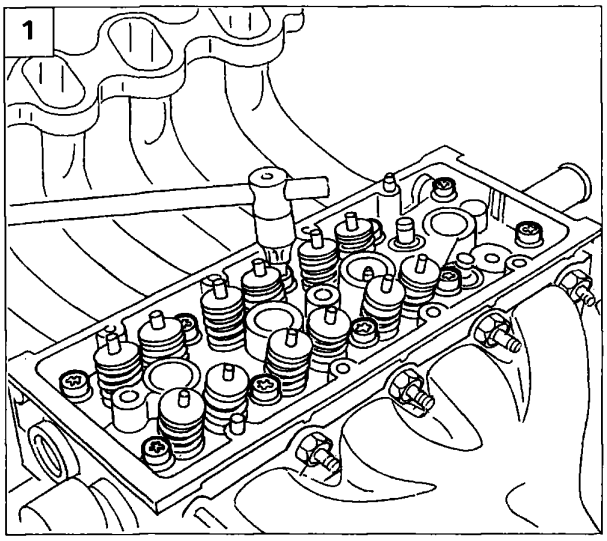
4A24HX04



4A24HX05

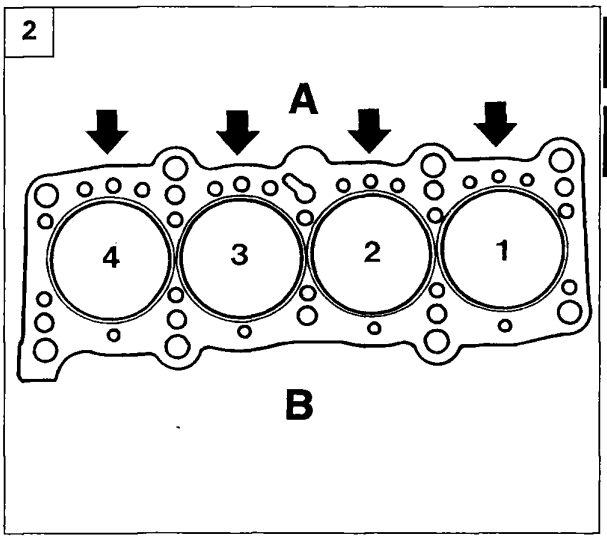


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4A25HX01

1. Using USAG spanner diameter 10 233 1/2 S or a similar tool, undo the bolts fixing the cylinder head to the cylinder block/crankcase; then remove the cylinder head and the gasket underneath.



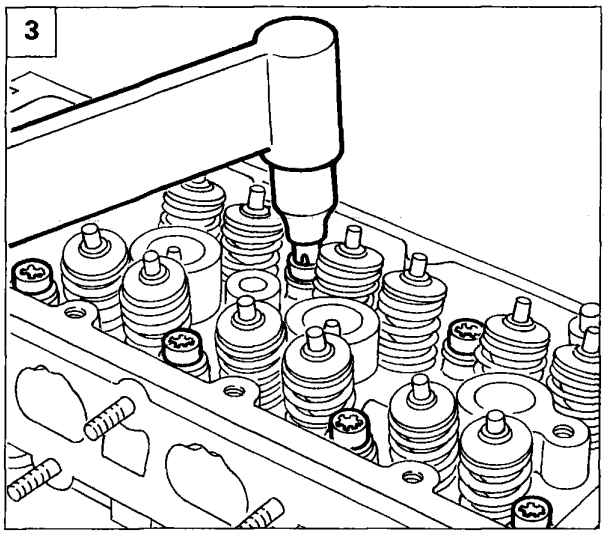
4A25HX02

Fitting cylinder head

2. Fit the gasket on the cylinder block with the word "ALTO" facing the operator, taking care not to get the gasket or the surface of the cylinder bock dirty or greasy. The diameters of the openings shown by the arrows increase from cylinders 1 to 4 so that the engine coolant is evenly distributed throughout the entire cylinder block.
   A = exhaust side
   B = inlet side

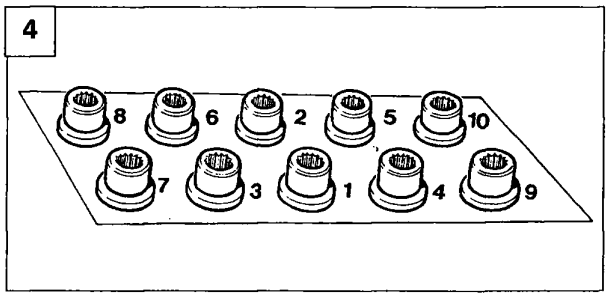
*'ASTADUR type cylinder head gaskets are fitted. On account of the special material from which these gaskets are made, they undergo a polymerization process during the operation of the engine becoming considerably harder during usage.*

*In order for the polymerization process to take place, the cylinder head gasket must be:*
- *kept in its sealed nylon container;*
- *only taken out of its casing shortly before fitting;*
- *not lubricated with oil or dirtied, taking care that the surface of the cylinder head and cylinder block are clean.*



4A25HX03

3-4. Position the cylinder head and tighten the bolts to a torque of 2 daNm following the order illustrated.

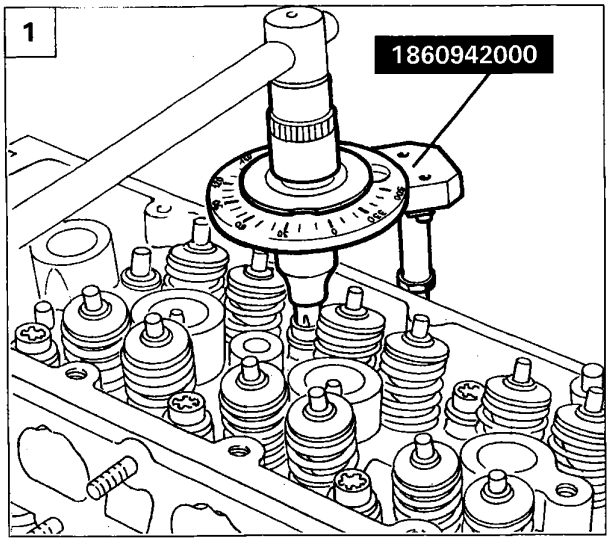


4A25HX04

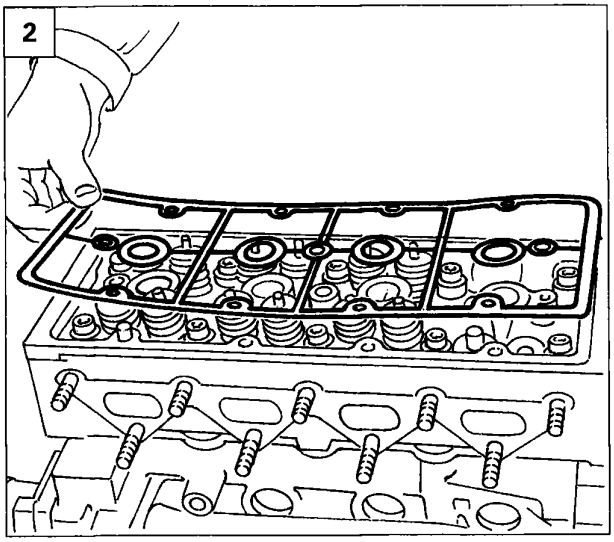


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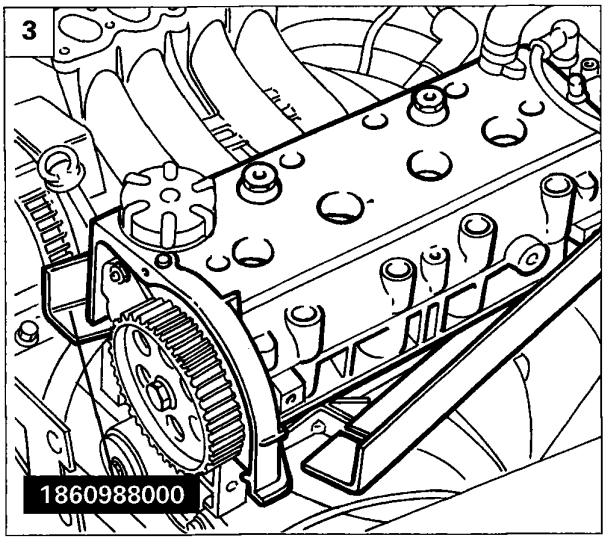
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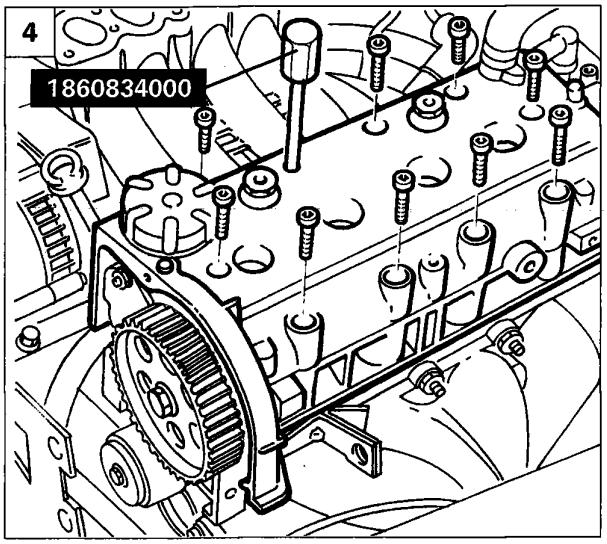
4A26HX01



4A26HX02



4A24HX05



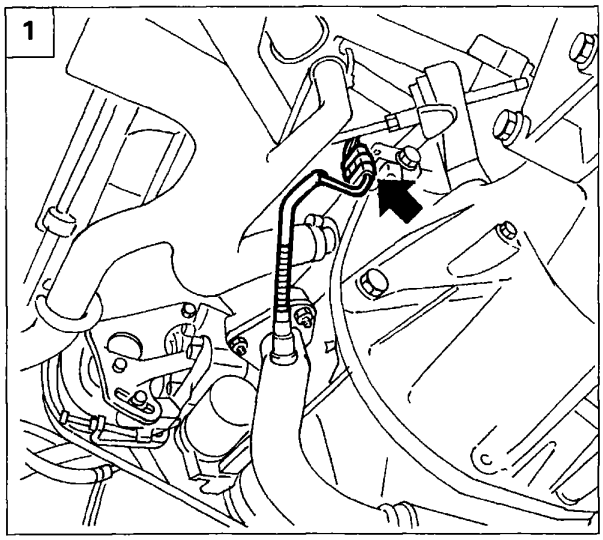
4A24HX04

1. Tightening bolts fixing cylinder head to cylinder block:
   STAGE 1: Tighten the bolts to a torque of 3 daNm, following the order illustrated previously.
   STAGE 2: Tighten the bolts through 90° using tool 1860942000.
   STAGE 3: Tighten all the bolts through a further 90°.
2. Positino the camshaft housing gasket on the cylinder head support plane.
3. Position the camshaft housing on the cylinder head, then remove the tappet retaining tools 1860988000.
4. Using spanner 1860834000, tighten the bolts fixing the camshaft housing to the cylinder head to the recommended torque; then position the protective caps for the bolts.

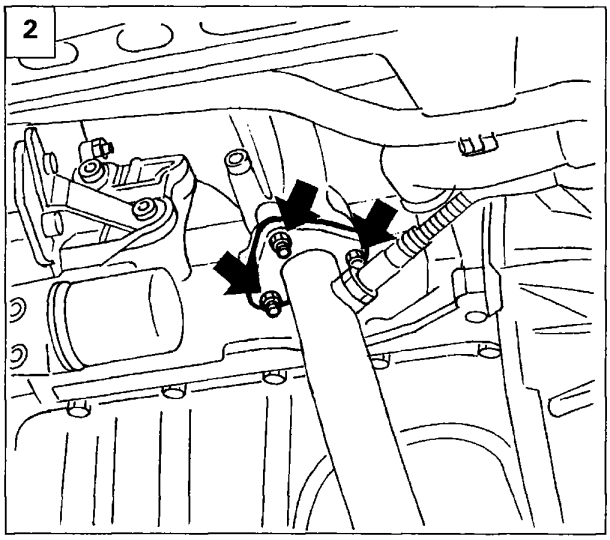
*Proceed with refitting the remaining components, reversing the order of the operations described for the removal. When refitting the timing belt, refer to the previous paragraph.*



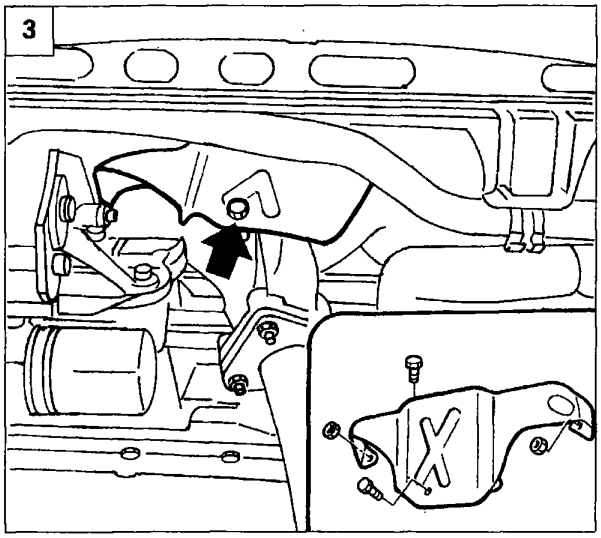
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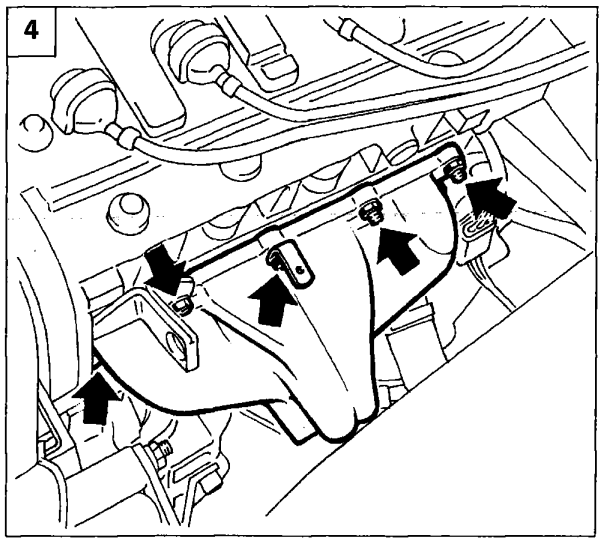

4A27HX01




4A24HX02




4A19HX02




4A27HX02

## REMOVING-REFITTING EXHAUST MANIFOLD

1. Disconnect the Lambda sensor connector.

2. Undo the nuts fixing the first section of the exhaust pipe to the manifold.

3. Undo the heat shield fastenings and remove it.

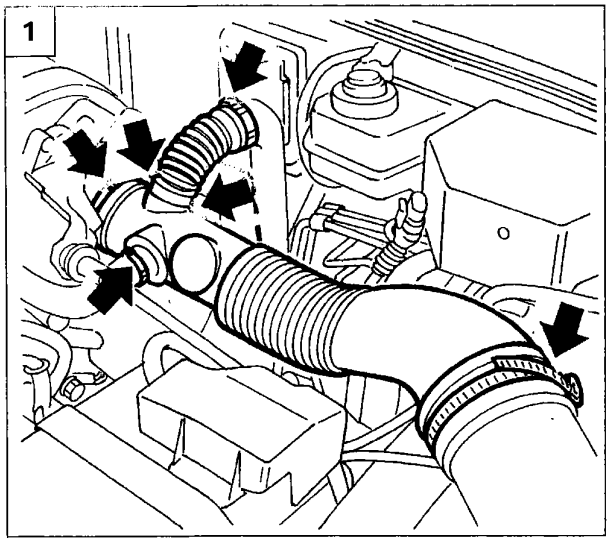
4. Undo the nuts fixing the exhaust manifold and remove it complete with the gasket underneath.

*Copyright Fiat Auto*

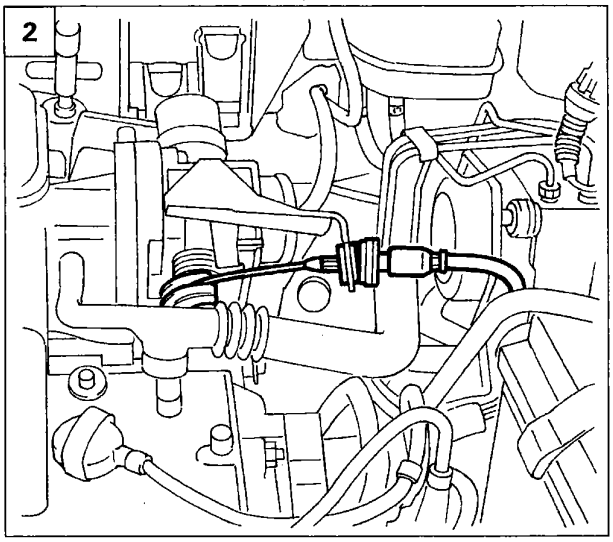


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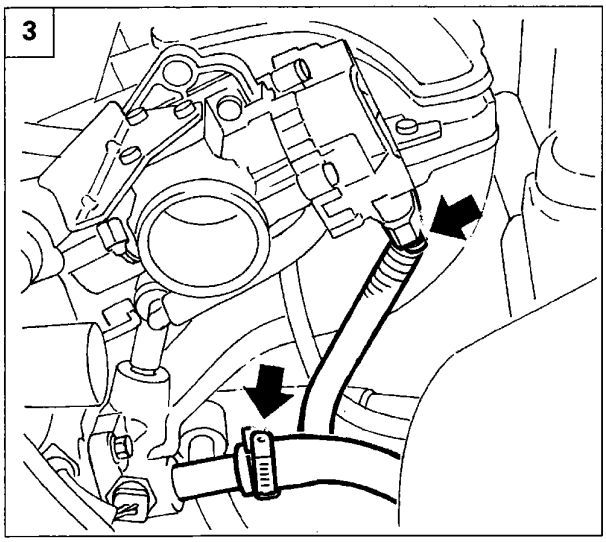
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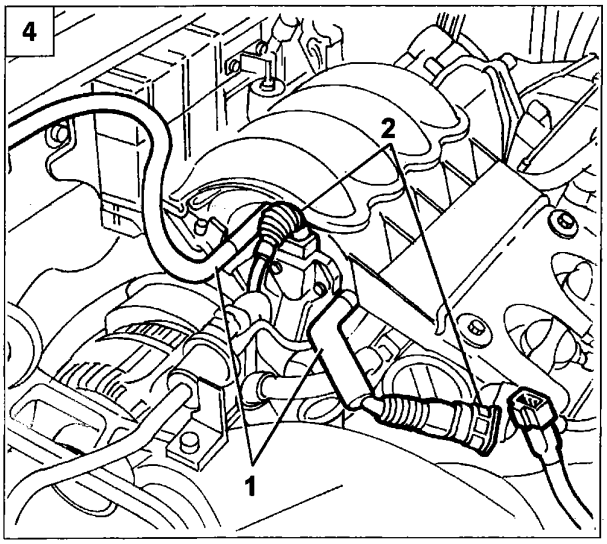
4A18HX01



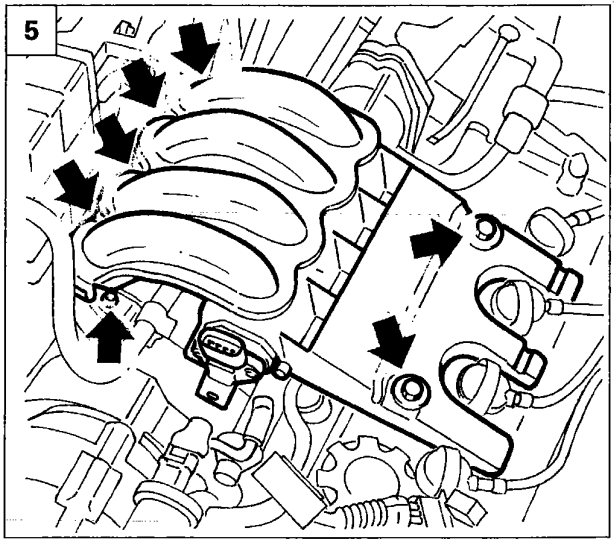
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4A18HX03



4A18HX04



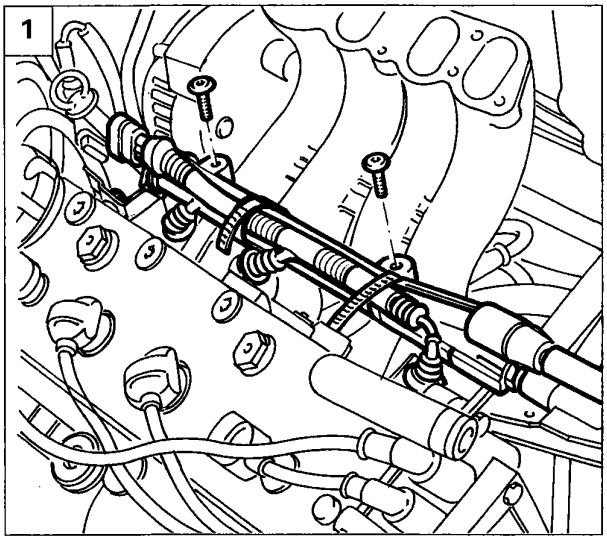
4A18HX05

## REMOVING-REFITTING INTAKE MANIFOLD

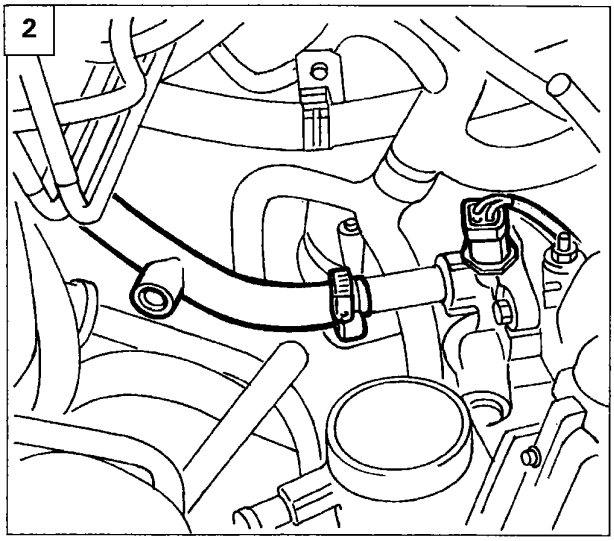
1. Remove the resonator, complete with air intake hose, disconnecting the bands shown and undoing the fixing bolts. Also disconnect the oil vapour recovery pipe from the lower part of the resonator.
2. Disconnect the accelerator cable.
3. Disconnect the connections illustrated and the brake servo vacuum pipe from the butterfly casing.
4. Disconnect the pipes (1) and the connections (2) from the upper part of the intake manifold.
5. Remove the fixing bolts for the upper part of the intake manifold using spanner USAG TX 27 or a similar tool, disconnect the oil vapour recovery pipe (1) and remove the manifold from the vehicle, complete with butterfly casing.



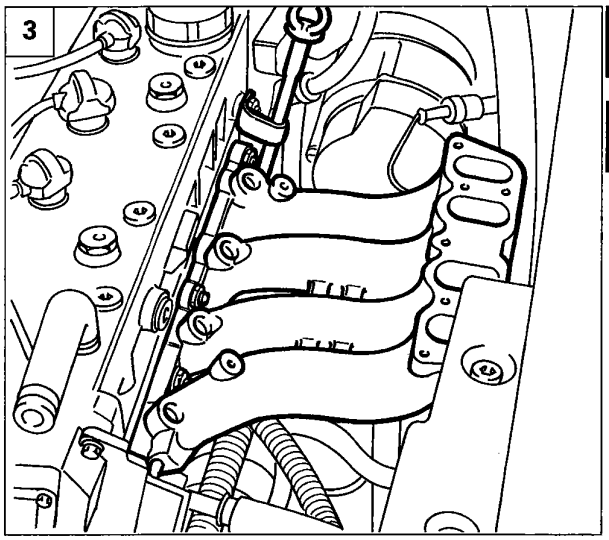
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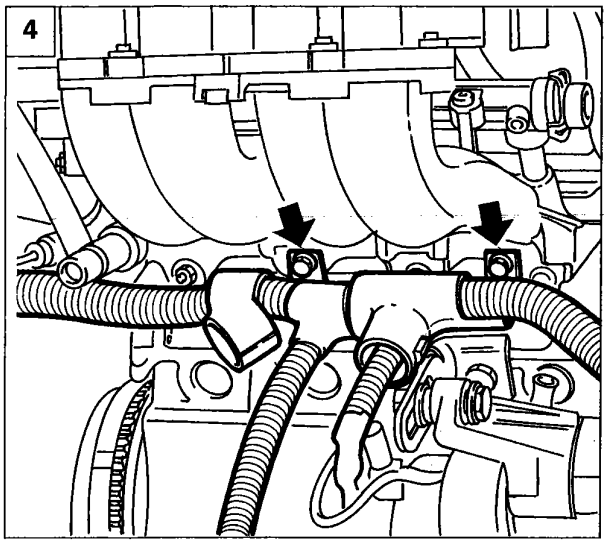



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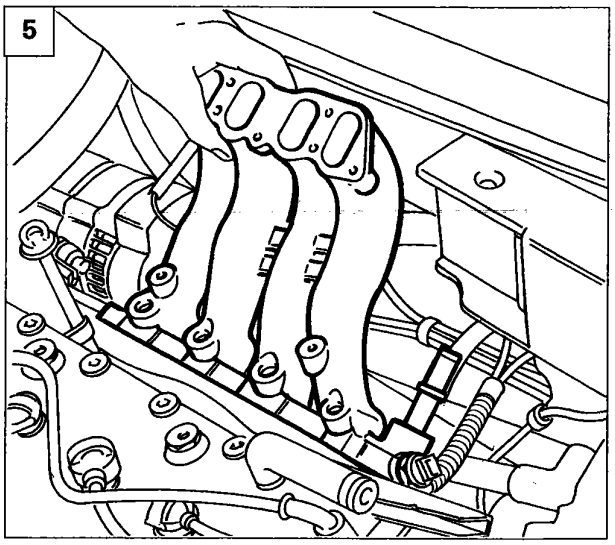



4A29HX03

1. Undo the bolts fixing the fuel manifold, remove it, cmoplete with injectors, and position it outside of the work area.
2. Disconnect the output pipe from the heater and the connector (1).
3. Undo the nuts fixing the intake manifold and release the engine oil dipstick retaining bracket.
4. Gently extract the intake manifold and release the injection cables from the lower part, acting on the bolts fixing the retaining brackets.
5. Then extract the lower part of the intake manifold.




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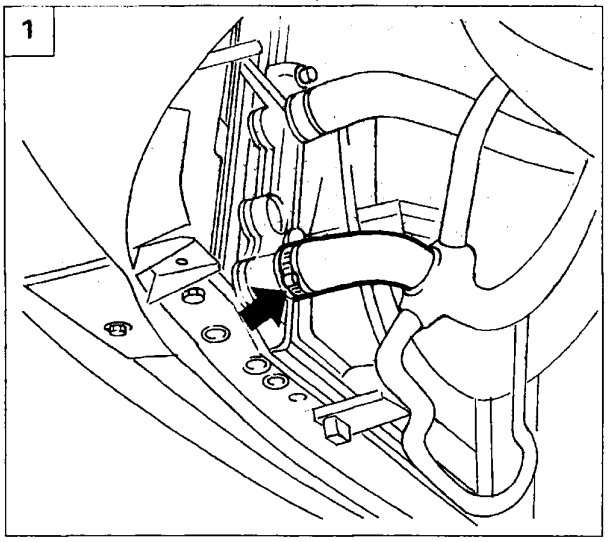



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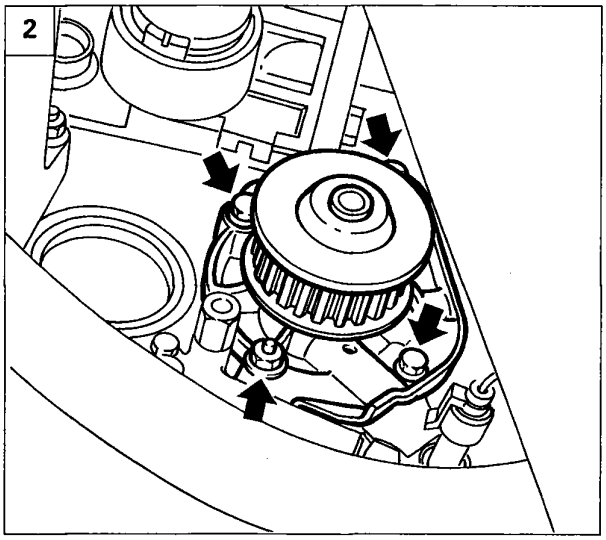



4A23HX01

## REMOVING-REFITTING WATER PUMP

1. Positin the vehicle on a lift, disconnect the negative battery lead, then drain the engine coolant, disconnect the hose shown from the lower part of the radiator.

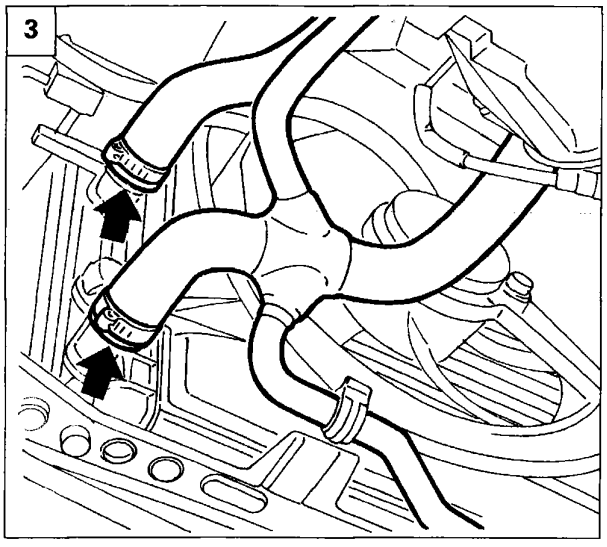
*Remove the timing drive belt as described in the previous paragraphs.*




4A30HX02

2. Remove the water pump, acting on the fastenings illustrated.

*Refit the components removed previously, tension the timing belt as described in the previous paragraphs.*




4A30HX03

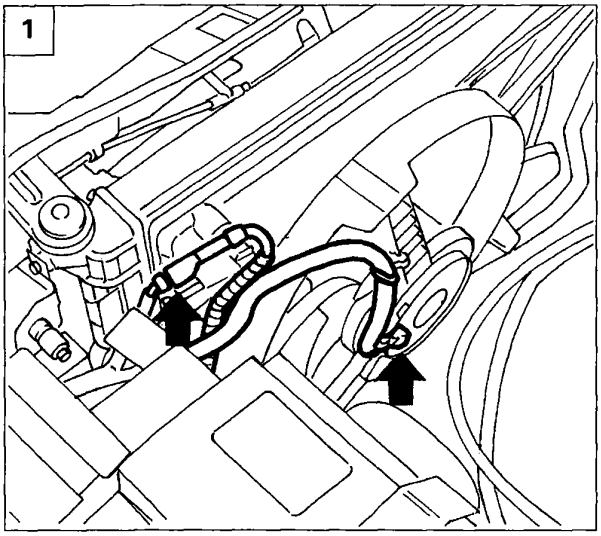
## REMOVING-REFITTING RADIATOR

Position the vehicle on a lift, disconnect the negative battery lead, then proceed as described below:

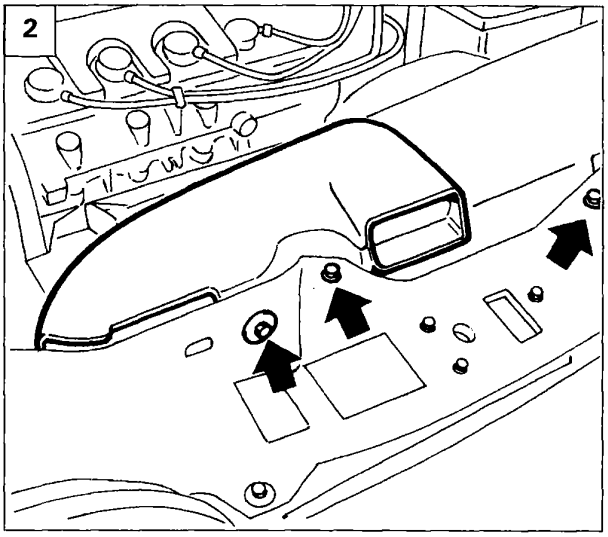
3. Drain the engine coolant, disconnecting the pipes shown in the diagram.



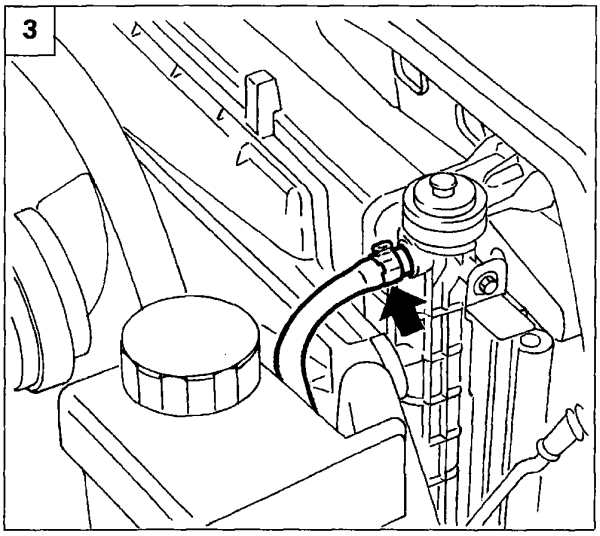
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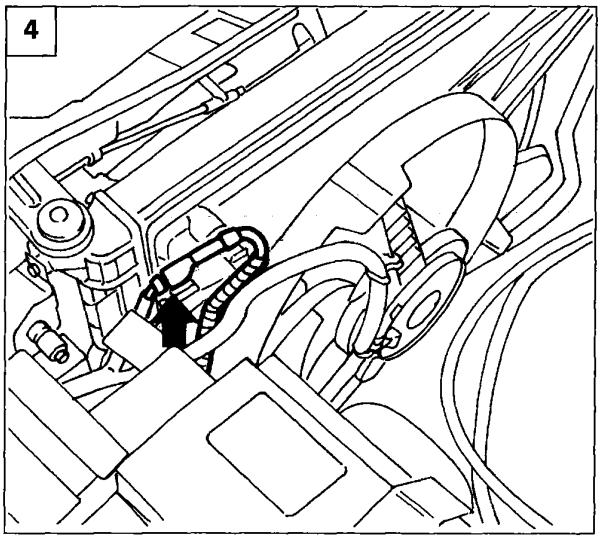

4A31HX01




4A31HX02




4A31HX03




4A31HX04

1. Disconnect the fan supply connections.

2. Undo the three bolts and remove the air intake, disconnecting it from the air filter hose.

3. Open the band and disconnect the pipe between the radiator and the tank.

4. Remove the engine cooling fan, undoing the fixing bolts then undo the bolts fixing the radiator to the condenser and to the bodyshell and extract the radiator upwards.

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# 10.

## PROCEDURE FOR REFILLING ENGINE COOLING SYSTEM (version with heater)

Total capacity of system: 4.67 litres

### Method for draining circuit

If necessary, the system can be drained as follows:
1. Remove the cap from the expansion tank (3) and open the bleed screw (5) on the radiator, the bleed screw (6) on the heater inlet hose and the bleed screw (7) on the heater outlet hose.
2. Disconnect the coolant return pipe (12) from the radiator and recover the engine coolant which comes out in a suitable container. When this operation is completed, restore the connection for the pipe (12) with the radiator, using a new band.

### Method for refilling the circuit

1. Check that the bleed screw (5) on the radiator, the bleed screw (6) on the heater inlet hose and the bleed screw (7) on the heater outlet hose are open.
2. Refill the system by slowly introducing coolant (a mixture of 50% water and paralu) until coolant comes out of the bleed screw (5) on the radiator, then close it.

   Continue filling until fluid comes out of the bleed screw (6) on the heater inlet hose (at this point fluid should not come out of the bleed screw (7) on the coolant outlet hose and the MAX level on the expansion tank should be reached). Then close the bleed screws (6) and (7) and the cap on the expansion tank (3).
3. Working from inside the vehicle, set the maximum heating condition, turning the air temperature adjustment knob to the maximum temperature position (red sector) and the fan speed adjustment knob to the maximum ventilation position.
4. Start up the engine and let it idle for about 2 - 3 minutes. Partly (2 - 3 threads) open the bleed screw (7) on the heater outlet hose in order to completely bleed the heat, slightly increase the engine speed until coolant comes out of this bleed screw, then close it.
5. Then carry out gradual, periodic accelerations (about every 30 seconds) up to 3/4 of the maximum power speed. During this operation, check the engine coolant temperature gauge and make sure that hot air is coming out of the vents; if this is not the case, loosen the bleed screw (7) and repeat the procedure described in point 4.

   This operation should be carried out until the engine cooling fan comes on for the first time.

   Let the engine idle again, undo the bleed screw (5) on the radiator carefully (because of the high temperature of the coolant) to allow any residual air to escape.

   Slowly increase the engine speed until fluid comes out of the bleed screw (5); close the bleed screw (5) and restore the idle speed. Keep the engine idlign for at least 5 minutes. Stop the engine and wait for it to cool down. The level of the fluid, when cold, should settle down between the MIN and MAX references on the expansion tank.

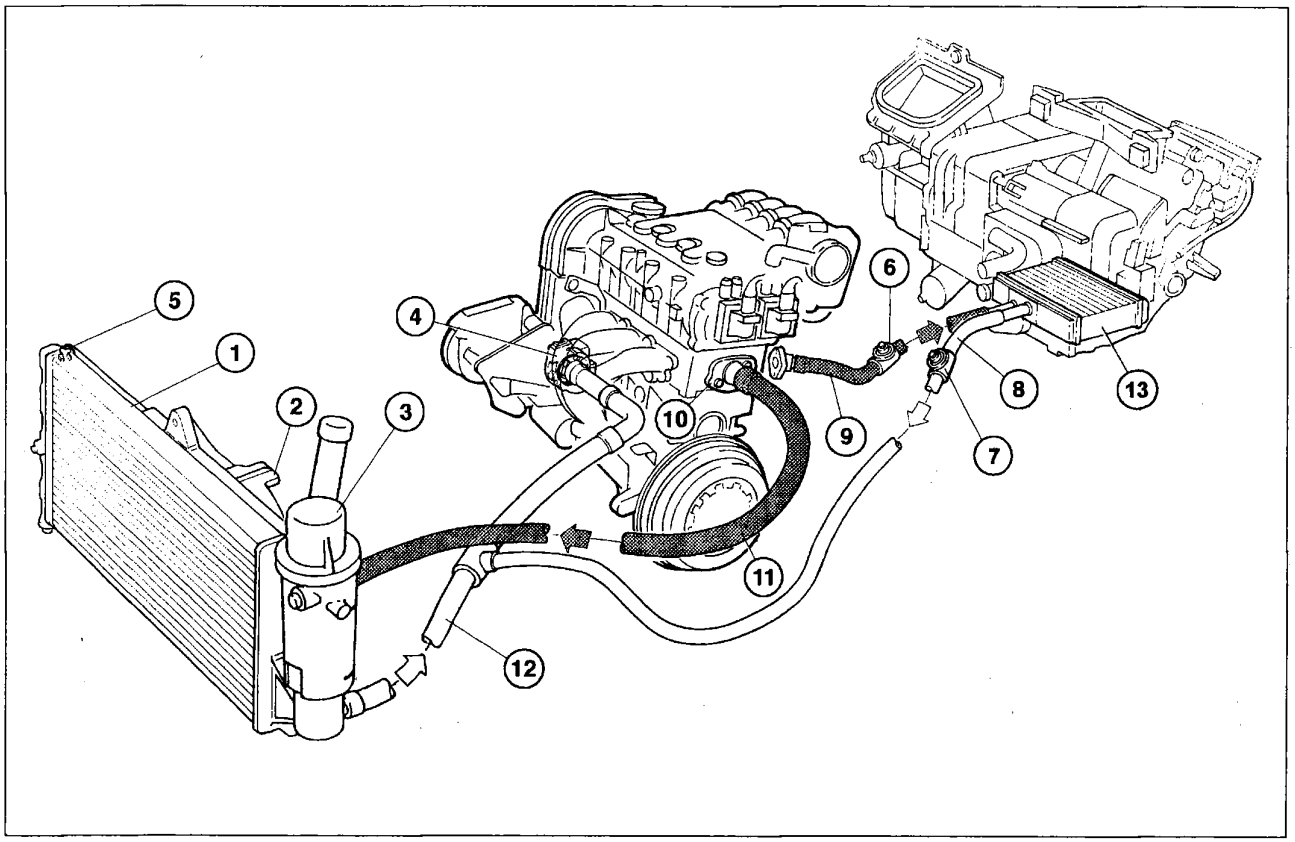
   When the operation is completed, check that the quantity of fluid introduced is at least equal to or more than that recovered when draining system system.

**NOTE** *If, during the operations described in point 5, the coolant should boil, then the procedure should be halted and repeated starting from the operation described in point 4.*



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Engine cooling system components (version with heater)




4A33HX01

1. Engine coolant radiator
2. Engine cooling fan
3. Coolant expansion tank
4. Engine cooling system pump
5. Bleed plug on heater inlet hose
6. Bleed plug on heater outlet hose
7. Coolant return pipe from car interior heater radiator to engine cooling radiator
8. Coolant supply pipe to car interior heater radiator
9. Coolant by-pass thermostat
10. Coolant supply pipe from thermostat to engine cooling radiator
11. Coolant return pipe from radiator to pump
12. Connecting pipes from radiator to expansion tank
13. Car interior heater radiator

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# 10.

## PROCEDURE FOR REFILLING ENGINE COOLING SYSTEM (version with air conditioning)

Total capacity of system: 4.45 litres

### Method for draining the circuit

The system can, if necessary, be drained as follows:

1. Remove the cap from the expansion tank (3) and open the bleed screw (5) on the heater inlet hose and the bleed screw (6) on the heater outlet hose.
2. Disconnect the coolant return pipe (11) from the radiator and recover the engine coolant which comes out in a suitable container. When this operation is completed, restore the connection for the pipe (11) with the radiator, using a new band.

### Method for refilling the circuit

1. Check that the bleed screw (5) on the heater inlet hose and the bleed screw (6) on the heater outlet hose are open.
2. Refill the system by slowly introducing coolant (a mixture of 50% water and paraflu) until coolant comes out of the bleed screw (5) on the heater inlet hose and the bleed screw (6) on the coolant outlet hose. Then close the bleed screws (5) and (6).

   Complete the refilling until the MAX reference on th expansion tank (3) is reached. Then refit the cap on the tank (3).
3. Working from inside the vehicle, set the maximum heating condition, turning the air temperature adjustment knob to the maximum temperature positino (red sector) and the fan speed adjustment knob to the maximum ventilation position and switch the air conditioning OFF.
4. Start up the engine and let it idle for about 2-3 minutes. Partly (2-3 threads) open the bleed screw (6) on the heater return hose in order to completely bleed the heater, slowly increase the engine speed until coolant comes out of the above mentioned bleed screw, then close it again.
5. Then carry out gradual, periodic accelerations (about every 30 seconds) until 3/4 of the maximum power speed is reached, at the same time introducing engine coolant into the expansion tank, but not beyond the MAX level. During this operation, check the engine coolant temperature gauge and make sure that hot air is coming out of the vents; if this is not the case, repeat the operations described in point 4.

   This operation should be carried out until the engine cooling fan comes on for the first time.

   Let the engine idle for at least 5 minutes, then switch it off.

   If necessary, top up until the level is between the MIN and MAX marks on the expansion tank. This operation should be carried out after having left the engine too cool down so that the temperature of the coolant is not above 25°C.

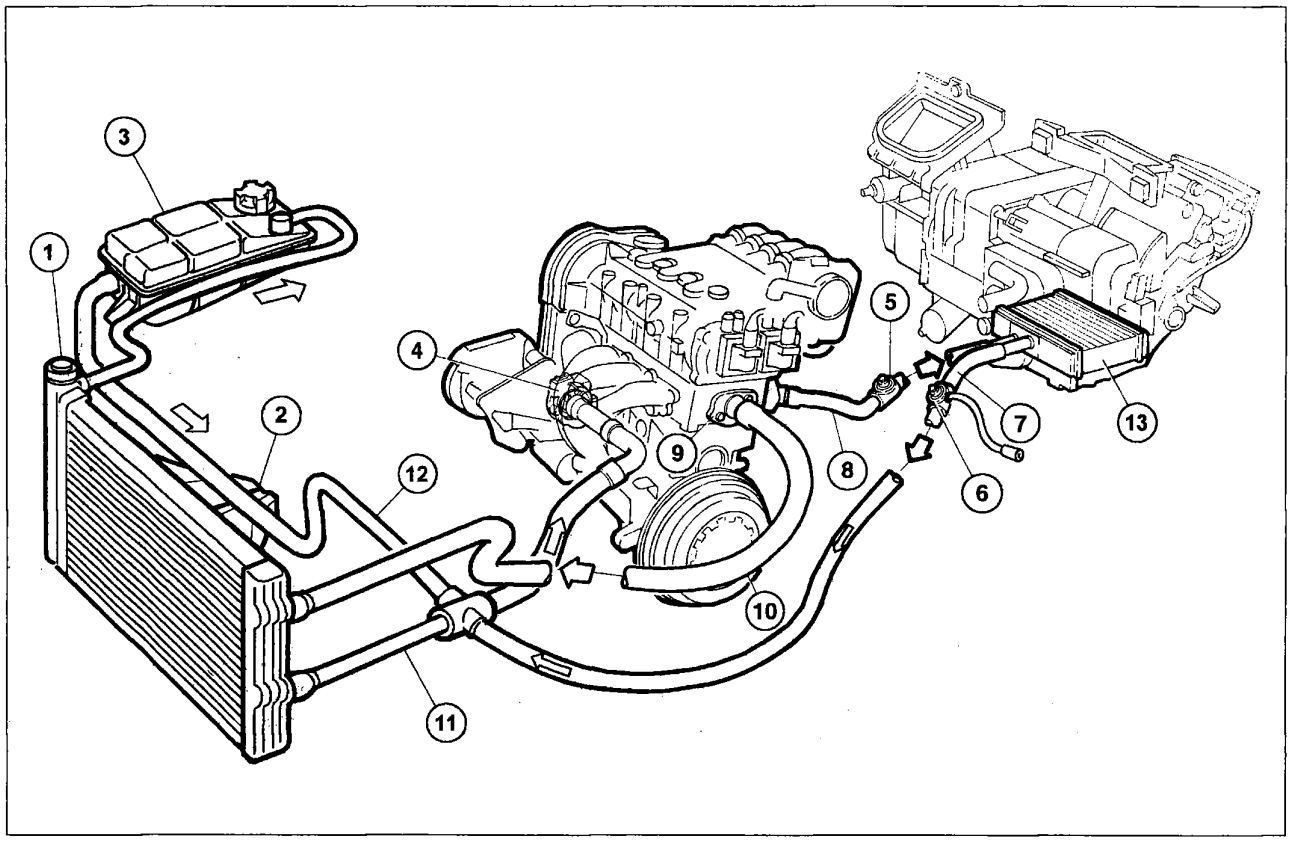
   When the operation is completed, check that the quantity of fluid introduced is at least equal to that recovered when the system was drained.

**NOTE** *If, during the operations described in point 5, the coolant should boil, the procedure should be interrupted and repeated starting from the operation described in point 4.*



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## Engine cooling system components (version with air conditioning)




4A35HX01

1. Engine cooling radiator
2. Engine cooling fan
3. Coolant expansion tank
4. Engine cooling system pump
5. Bleed plug on heater inlet pipe
6. Bleed plug on heater outlet pipe
7. Coolant return pipe from car interior heater radiator to engine cooling radiator
8. Coolant supply pipe to car interior heater radiator
9. Coolant by-pass thermostat
10. Coolant supply pipe from thermostat to engine cooling radiator
11. Coolant return pipe from radiator to pump
12. Connecting pipes from radiator to expansion tank
13. Car interior heater radiator



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## INTEGRATED INJECTION-IGNITION SYSTEM - M.MARELLI-WEBER I.A.W.-49F

### Introduction

The I.A.W.-49F fitted to the 1581 i.e. 16v engine belongs to the category of digital electronic ignition systems with static advance and timing, integrated with a phased, multipoint, intermittent electronic fuel injection system.

System identification codes change according to the version:
- I.A.W.-49F.B6 for version with manual gearbox
- I.A.W.-49F.L3 for version with automatic transmission

This system therefore adopts a single ECU, single wiring system and a set of sensors common to both systems.

Its function is therefore to inject an exact quantity of fuel into the engine intake duct upstream of the intake valves in order to obtain the correct mixture concentration.

The I.A.W.-49F system ensures efficient operation and optimisation of performance and fuel consumption. Harmful emission levels are reduced through real time response to the various engine operating conditions.

The system may be divided schematically into the following subsystems:
- Electric/electronic circuit
- Air intake circuit
- Fuel feed circuit
- Emission control devices

The system is able to monitor the following parameters by means of dedicated sensors:
1. instantaneous engine rpm;
2. position of each piston pair in relation to TDC of cylinder 1;
3. intake air temperature;
4. throttle valve angular position;
5. coolant temperature;
6. actual mixture concentration (by means of lambda probe signal);
7. intake manifold pressure;
8. vehicle speed;
9. battery voltage;
10. air conditioner compressor activation (if fitted).
11. presence of knock

This data, generally analogue, is converted into digital signals by analogue/digital (A/D) converters so that it may be used by the ECU.
Note that this I.A.W.-49 injection-ignition sytem does not require adjustment because it is self-adjusting and self-adaptive.

## SYSTEM OPERATING STRATEGIES

The management software resident in the ECU memory comprises a set of strategies. Each of these controls a specific system control function.
Each strategy uses the various inputs listed above to process a set of parameters, using data maps saved in specific areas of the ECU. The resulting data output is used to control system actuators, in other words the devices used to operate the engine, namely:

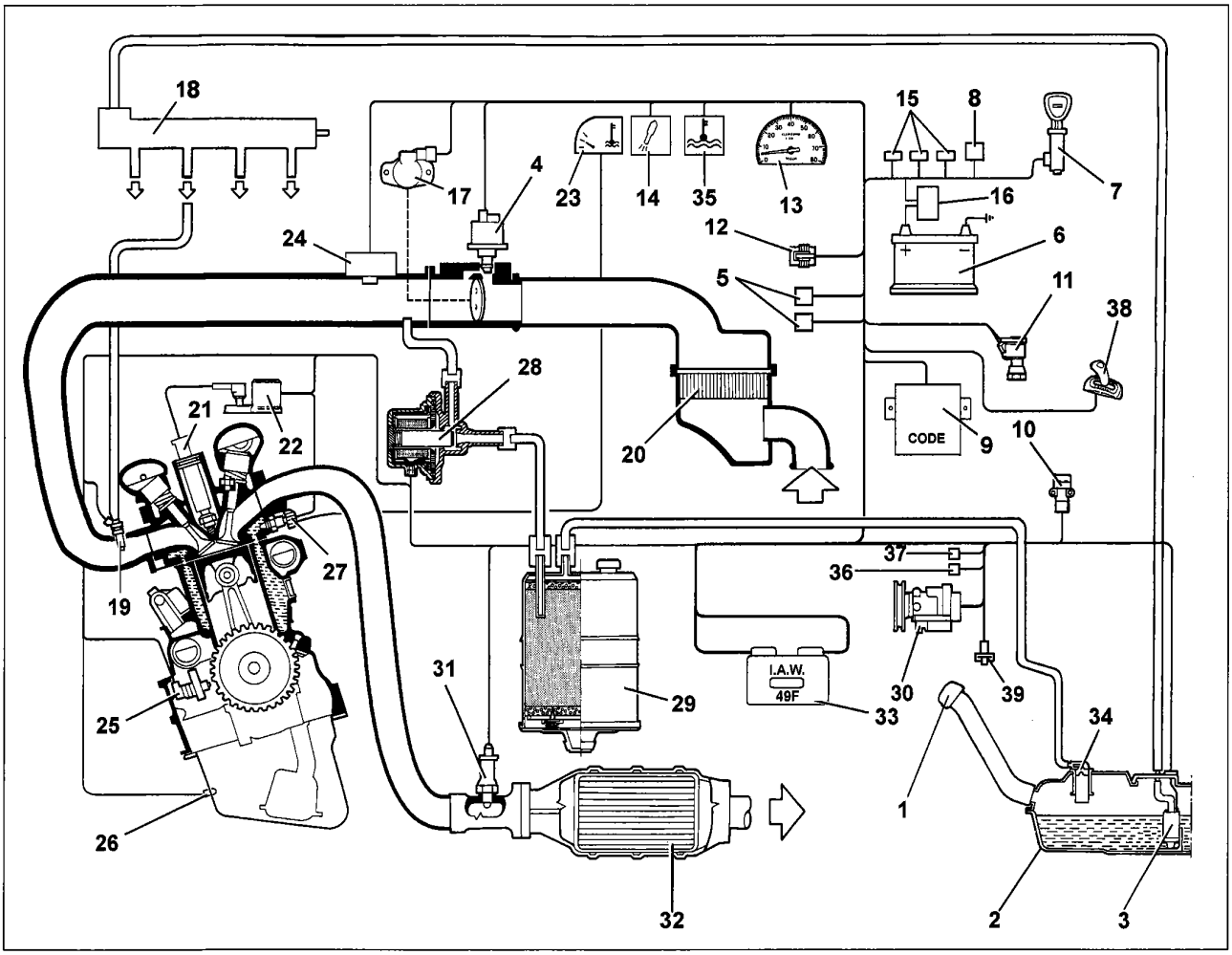
1. injectors;
2. ignition coils;
3. solenoids of various types;
4. electric fuel pump;
5. engine idle speed actuator;
6. control relays.

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# 10.

## INJECTION-IGNITION SYSTEM OPERATING DIAGRAM




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1. Safety and ventilation valve
2. Fuel tank
3. Electric fuel pump
4. Idle speed actuator
5. Radiator fan high and low speed control relays
6. Battery
7. Ignition switch
8. Injection system relay
9. FIAT CODE control unit
10. Inertia switch
11. Vehicle speed sensor
12. Tester socket
13. Rev counter
14. Injection system warning light
15. Injection - ignition system fuses
16. Master fuse box
17. Throttle valve position sensor
18. Fuel supply manifold
19. Injectors
20. Air cleaner
21. Spark plugs
22. Ignition coils
23. Coolant temperature gauge
24. Pressure and air temperature sensor
25. Rpm and TDC sensor.
26. Knock sensor
27. Coolant temperature sensor
28. Fuel vapour cut-off solenoid
29. Active carbon trap filter
30. Air conditioner compressor
31. Lambda probe
32. Catalytic converter
33. Injection - ignition control unit
34. Multifunction valve
35. Excessive engine coolant temperature warning light
36. Air conditioner compressor relay
37. Heating/ventilation system relay
38. Automatic transmission
39. Pressure switch



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The management strategies control ignition advance and fuel supply as effectively as possible to ensure mixture concentration is constantly corrected as engine load and environmental conditions change.

System operating strategies are essentially as follows:

-injection management;
-ignition management;
-Fiat CODE immobiliser function management;
-radiator fan management
-engine idle control;
-fuel vapour recirculation management;
-test management
-heating/ventilation system management

## INJECTION MANAGEMENT

The ignition management strategies are designed to provide the engine with the correct amount of fuel at the right moment in accordance with engine service conditions.

The injection-ignition system uses an indirect measurement system known as «SPEED DENSITY - LAMBDA», i.e. angular speed of rotation, intake air density, retro-active concentration check.

In practice this system uses ENGINE SPEED (revs per minute) and AIR DENSITY (pressure and temperature) to measure the amount of air taken in by the engine.

The amount of air taken in by each cylinder upon each engine stroke depends on intake air density and also on standard displacement and volumetric efficiency.

Air density is taken to be the density of air taken in by the engine and calculated as a function of absolute pressure and temperature - both measured in the inlet manifold.

Volumetric efficiency is a parameter relating to the cylinder filling coefficient. It is calculated on the basis of experimental tests carried out on the engine throughout its service range and then memorized in the ECU.

Once the amount of air taken in has been established, the system must provide sufficient fuel to make up the required fuel mixture concentration.

The injection trigger pulse or time at which fuel delivery begins is mapped in a control unit and alters according to engine speed and intake manifold pressure. In practice, the the ECU performs calculations in order to control sequential, phased opening of the four injectors, one per cylinder for the length of time strictly necessary to form an air-fuel mixture as close as possible to a stoichiometric ratio.

Fuel is injected directly into the manifold close to the intake valves at a differential pressure of some 3 bar.

Speed (no. of revolutions per minute) and air density (pressure and temperature) are used to measure intake air quantity, which is used in turn to calculate the amount of fuel needed to achieve the required mixture proportions. The other sensors in the system (coolant temperature, throttle valve position, battery voltage, etc.) allow the ECU to correct the baseline strategy for each specific engine service condition.

In order to keep the catalytic converter working efficiently and reduce polluting emissions, it is essential to ensure the air-fuel ratio is maintained at near stoichiometric levels.

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A stoichiometric ratio is achieved by using a hot lambda probe. This probe continually monitors the amount of oxygen in the exhaust gas and then informs the ECU. This unit in turn uses mapped data to correct the fuel air mixture on-line if proportions are no longer stoichiometric.

Idle speed, exhaust gas CO level and throttle valve sensor position cannot adjusted on this system.

**Control of mixture concentration (retro-active control)**

**NOTE** *Mixture ratio is defined and indicated by the Greek letter α (alpha) as follows:*

$$\alpha = \frac{\textbf{quantity of air taken in by engine}}{\textbf{quantity of fuel injected}}$$

The following ratio is said to be stoichiometric and indicated by αst:

$$\alpha st = \frac{\textbf{theoretical quantity of air required to burn all the fuel injected}}{\textbf{quantity of fuel injected}}$$

*The following ratio defines mixture concentration and is indicated by the Greek letter λ (lambda):*

$$\lambda = \frac{\textbf{quantity of air taken in by engine}}{\textbf{theoretical quantity of air required to burn all the fuel injected}}$$

Thus we easily find that $\alpha/\alpha st = \lambda$.

Stoichiometric ratio depends on fuel type. For unleaded fuels in current use, this figure is 14.7 - 14.8, which corresponds to lambda = 1. (a ratio of 14.8:1 means that 14.8 parts of air are required to burn 1 part of fuel).

The mixture is termed rich (or heavy) when the quantity if air is less than the stoichiometric level. In this case, lambda equals $\leq 1$;

the mixture is termed lean (or light) when the quantity of air exceeds the stoichiometric level. In this case, lambda equals $\geq 1$;

The strategy is designed to correct base pulse constants so that mixture concentration oscillates continually and at a high rate between 0.98 and 1.02.

This oscillation rate varies according to engine load and speed. It is in the order of a few Hertz (0.5 - 4 Hertz).

**NOTE**

*1 Hz = 1 oscillation per second*

Under conditions of:

- cut-off,
- throttle opening about 60% (lower at low speeds)
- engine temperature lower than 25 °C

the strategy is de-activated.



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### Self-adaptability

The control unit features a self-adaptive function able to memorise deviations between basic maps and corrections imposed by the lambda probe that occur persistently during operation. Such deviations (due to system and engine component ageing) are saved permanently so that system operation can be adapted to gradual changes in engine and components with regard to original specifications. The corrections are **NOT** lost even when the batter or control unit is disconnected

The strategy is de-activated while the carbon filter flushing solenoid is open. If the ECU is replaced, it is advisable to leave the engine to idle for a few minutes until warm to allow the ECU to store the correction again. Corrections at higher speeds are stored under normal driving conditions.

The control unit is also equipped with a self-adaptive function which corrects idle speed actuator opening when idling on the basis of changes due to throttle body leaks or natural engine ageing. This specific correction is lost by disconnecting the battery or control unit.

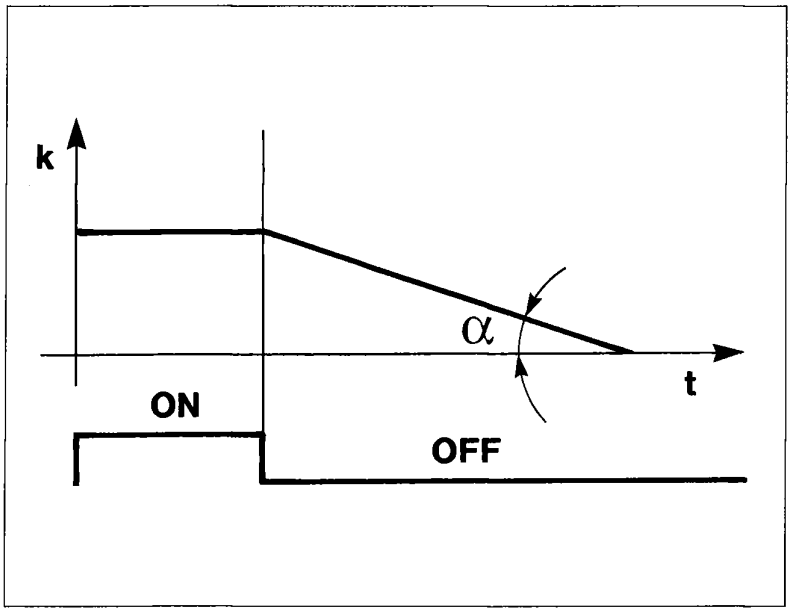
### Starting and post-starting

During start-up, engine phase cannot be instantly identified and phased injection cannot therefore be implemented for the first injection in each cylinder.

An initial simultaneous injection is carried out during the first few engine revolutions (full group) because the considerable fluctuations in rotation speed do not permit injection time to be calculated correctly. Only subsequently does injection becomes phased.

The base pulse constant is increased by a certain factor throughout the period when the engine is cranked by the starter motor.

Once start-up has taken place, the factor is gradually reduced to zero within a given time period, which is in inverse proportion to engine temperature.




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k : enrichment factor
t : time
α : decrease proportional to engine temperature

ON: engine cranked
OFF: engine running

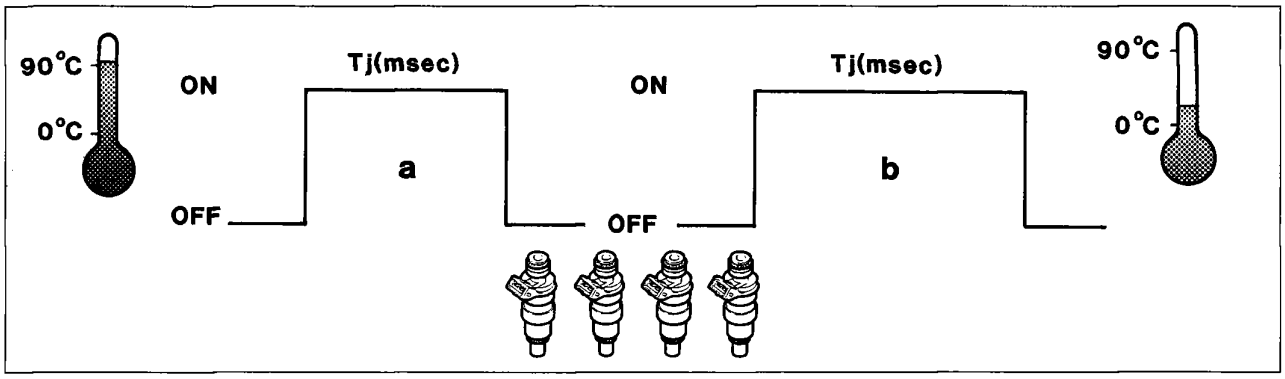


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**When cold**

Under these conditions, the mixture becomes naturally leaner due to reduced evaporation and heavy fuel condensation on the intake manifold internal walls. The greater viscosity of the lubrication oil also brings about an increase in the rolling resistance of internal engine components which also serves to exacerbate matters.

The electronic control unit recognises this condition and corrects injection time on the basis of the coolant temperature signal.




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Consequently:

- At very low temperatures the injector stays open longer Tj) graph (b) for a low air fuel ratio (rich mixtures);
- As engine temperature increases, injector opening time becomes shorter (tj) graph (a) and the air/fuel ratio becomes correspondingly higher (lean mixture).

While the engine is warming up, the ECU also governs a step motor which is responsible for calculating the amount of air necessary to ensure the engine does not stall.

Rpm is decreased as the temperature rises until the rated level is reached (850 ± 30 Rpm) when the engine is warm. The ECU governs the step motor to maintain idle speed constant even if electrical and mechanical loads vary.

**Connection to automatic transmission**

The ECU adjusts engine idle speed on the basis of the load input when the selector lever is moved to a given position and transmits information to the automatic transmission ECU on torque reduction (pin 36), engine coolant temperature (pin 5) and throttle valve position (pin 16).

The control unit reduces the level of torque produced by the engine (mainly by altering ignition advance) during gear changes, when it receives a signal from the automatic transmission control unit (pin 49).

**Full-load**

Under full load conditions, base pulse constant must be increased to obtain maximum engine power output.

The ECU detects a full load condition as a result of parameters supplied by the throttle position and absolute pressure sensors.

On the basis of this information, the ECU implements the appropriate correction strategy by increasing base pulse constant.



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### Over-run

Two strategies are superimposed during this stage:

1. Transient negative strategy to reduce the amount of fuel required by the engine (lower emissions). This stage is recognized by the ECU when the potentiometer signal changes from a higher voltage level to a lower value.
2. A dash-pot strategy to lessen changes in torque delivery (lower engine brake). This strategy is implemented when the potentiometer signal indicates that the throttle is closed and rpm is high. The step motor gradually decreases the flow of air through the by-pass.

### Barometric correction

Atmospheric pressure varies with altitude to bring about changes in volumetric efficiency of sufficient entity to require a correction to baseline concentration (injection time).

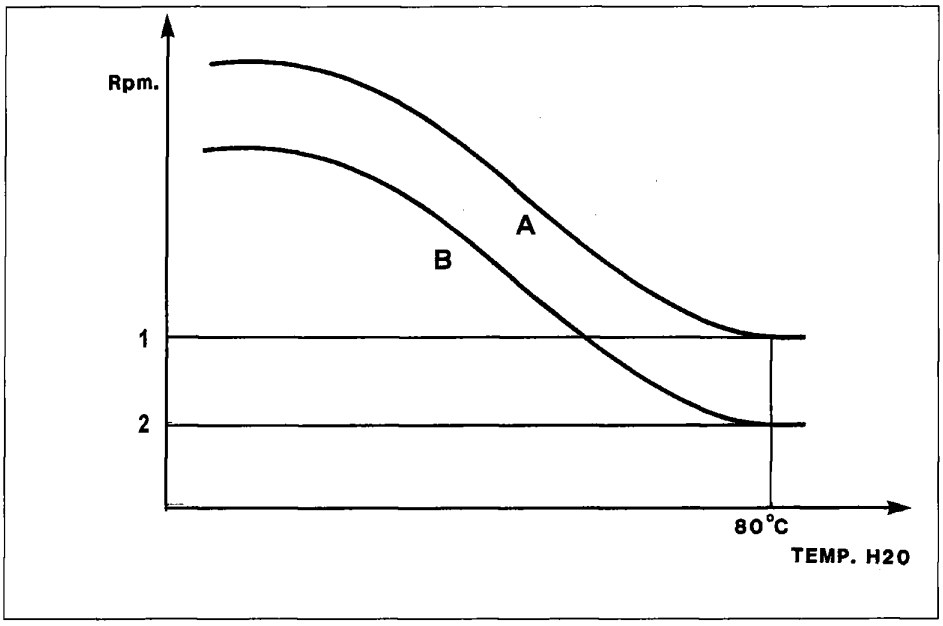
Injection time is corrected according to changes in altitude and updated automatically by the ECU whenever the engine is started up and under certain conditions of throttle position and rpm (dynamic adjustment of barometric correction)

### Cut-off

The fuel cut-off strategy is activated when the ECU recognises that the throttle is in closed position (throttle potentiometer signal) and engine speed exceeds 1350 rpm (1750 rpm for automatic transmission versions). The ECU activates cut-off only when engine temperature exceeds 0° C.

The fuel supply is restored when the throttle is no longer closed or the engine speed is lower than 1270 rpm (1650 rpm for version with automatic transmission).

At very high speeds, cut-off takes place even when the throttle valve is not fully closed but pressure in the intake manifold is particularly low (partial cut-off).




Version with manual gearbox

1. 1350 rpm
2. 1270 rpm

Version with automatic transmission

1. 1750 rpm
2. 1650 rpm

A. entering cut-off

**B**. leaving cut-off



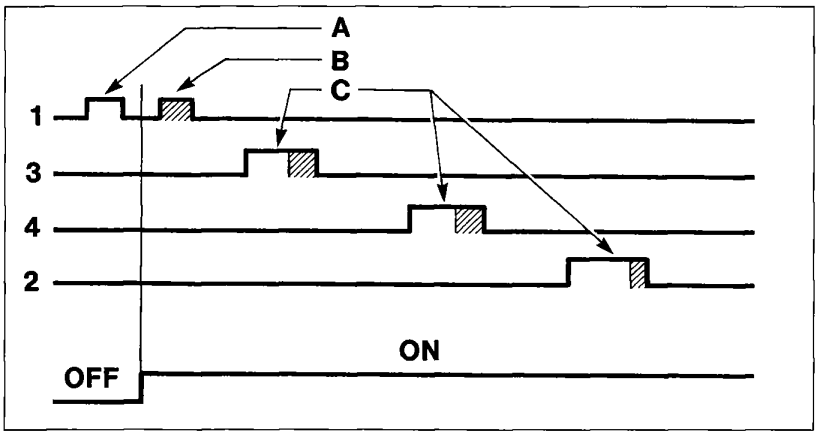
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**Acceleration**

During this stage, the ECU increases the amount of fuel required by the engine (to achieve maximum torque) on the basis of signals from the following sensors:
- throttle potentiometer;
- absolute pressure sensor;
- rpm and TDC sensor.

The base pulse constant is multiplied by a factor according to coolant temperature and accelerator throttle opening speed.

If an abrupt change in injection time is calculated when the injector is already closed, the ECU reopens the injector (extra pulse), in order to make the concentration up to the required level as quickly as possible. Subsequent injections are automatically increased as described previously.




P4F08IJ01

A. normal injection time
B. injector re-opening (extra pulse)
C. injection time including enrichment
OFF. engine under steady-state conditions
ON. engine under transient conditions

**Protection against excess rpm**

When engine rpm exceeds a level of 6700 rpm for longer than 10 seconds or an upper threshold of 6900 rpm imposed by the manufacturer for any length of time, engine operating conditions are said to be critical.

When the ECU recognises that this threshold rpm level has been exceeded, it reduces injector control time.

When rpm drops to non-critical levels, control is restored.

**Electric fuel pump drive**

The fuel pump is governed by the ECU through a relay.
The pump stops when:

- engine speed drops below 50 rpm;
- after a certain time (5 seconds) with the ignition turned to MAR without start-up taking place (timed enablement).
- if the inertia switch is activated.

**Injector control**

Injectors are controlled in sequential, phased manner. During start-up, however, all injectors are initially all controlled in parallel (full-group).

Injector control timing varies according to engine speed and intake air pressure in order to improve cylinder filling because this makes for better fuel economy, good handling and lower emission levels.



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## IGNITION MANAGEMENT

The ignition circuit is static inductive discharge type, i.e. a high tension distributor with power modules located inside the injection-ignition control unit.

The system comprises two high tension twin outlet coils combined in a single container and connected directly to the spark plugs.

The primary winding of each coil is connected to the power relay (i.e. supplied by battery voltage) and pins of the ECU for connection to earth.

Once the start-up stage is over, the ECU implements a base pulse constant taken from a specific map in accordance with the following input parameters:

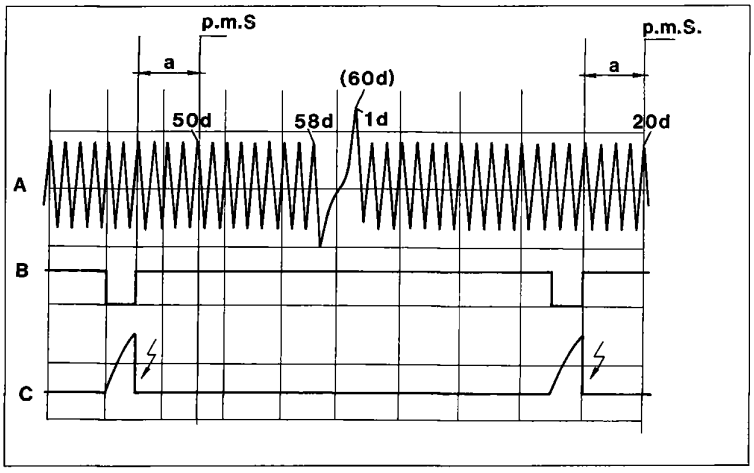
- engine rotating speed (rpm),
- absolute pressure reading (mmhg) obtained in intake manifold.

This advance setting is corrected according to temperature.

The advance angle is also subject to correction under the following conditions:

- during start-up;
- during transient stages of acceleration and over-run.
- during cut-off.
- to stabilise idle speed
- when knock is present
- when required by the automatic transmission ECU (speed change).

For the ignition system to work efficiently, the ECU must recognise the signal configuration.




P4F09IJ01

A. Rpm sensor signal

B. Power control

C. Current running through coil primary winding

a. Ignition advance with reference to cylinder TDC

The gap or change in signal generated by the lack of two teeth on the phonic wheel, more specifically between the 58th and 1st tooth (known also as the synchronism tooth) which occurs each time the crankshaft pulley turns is a reference signal which allows the ECU recognition 114° in advance of TDC of piston pair 1-4 in correspondence to falling front of 20th tooth.

Once the ECU (see following page) has received the correct T.D.C. signal configuration, it establishes the point at which conduction (supply) to primary circuits of coils (6) begins through internal power module (5).

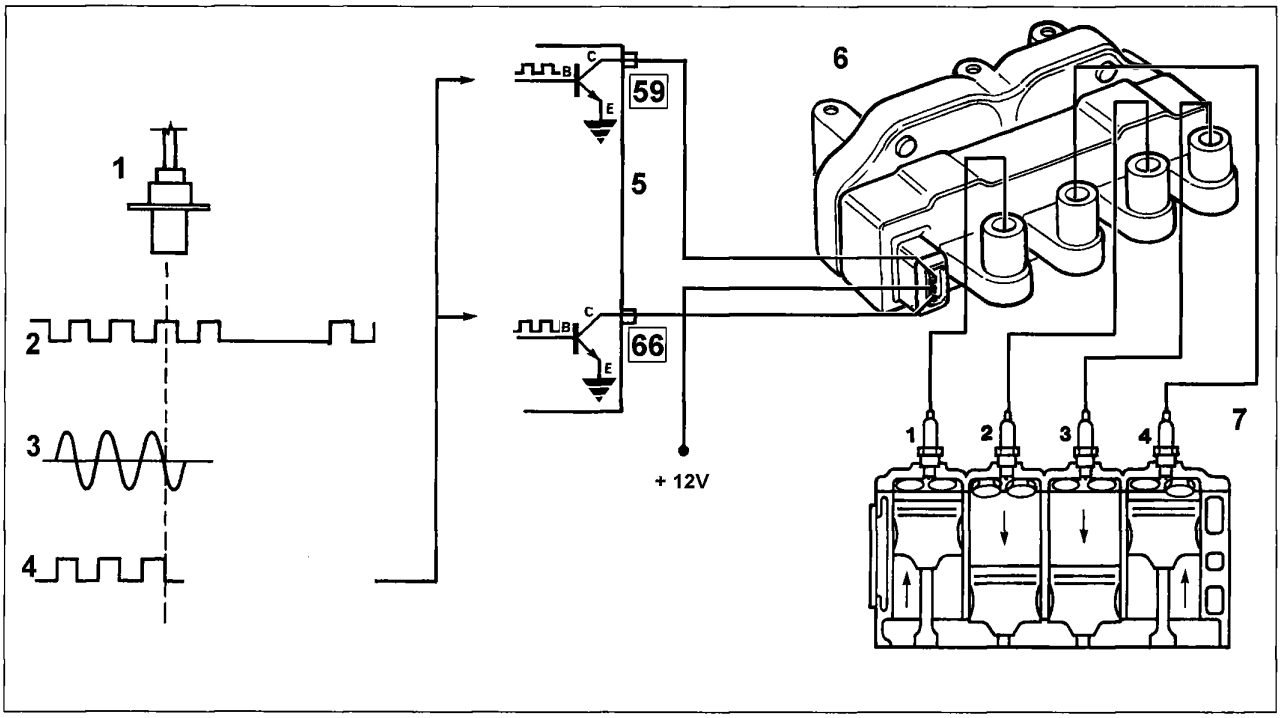


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The rising side of signal (graph B in figure on previous page) therefore represents a moment within which alternative primary winding conduction could take place. This point can be established only by the control unit power module. The conduction time the H.T. coil needs in order to store sufficient energy is also defined by DWELL management strategies. This depends on the time taken by the current to reach about 6A in the coil primary winding and also on the calculation algorithm run by the microprocessor which uses factors saved in a special memory, obviously based on engine rpm

With reference to the figure on the previous page, the falling side of the signal, (B) conduction end point (or current drop to zero), is a categorical order to cut-off the current flowing in the primary winding and represents the ignition advance point (a) processed by the computer (advance - (a) - varies according to rpm).

The control unit (ECU) then controls spark advance in the different cylinders in relation to top dead centre and conduction time necessary for the coil to store energy by controlling the two power stages (corresponding to ECU pins 59 and 66). These in turn permit current to flow through primary windings of coils (6) for long enough to ensure the specified 6A current rating.




P4F10IJ01

**Ignition operating diagram**

1. RPM and TDC sensor.
2. Phonic wheel.
3. Signal pattern taken from phonic wheel (60-2) teeth.

   TDCs correspond to teeth 20 and 50.
4. Succession of rectangular square wave signals of constant amplitude
5. Ignition power module ()inside control unit.
6. Ignition coils.
7. Spark plugs

**NOTE** *The numbers in boxes indicate the corresponding control unit pins*

At the moment when the ECU de-activates one of the two power stages, current flow is cut off. This generates a voltage by induction (up to 30kV without loads) in the secondary winding.

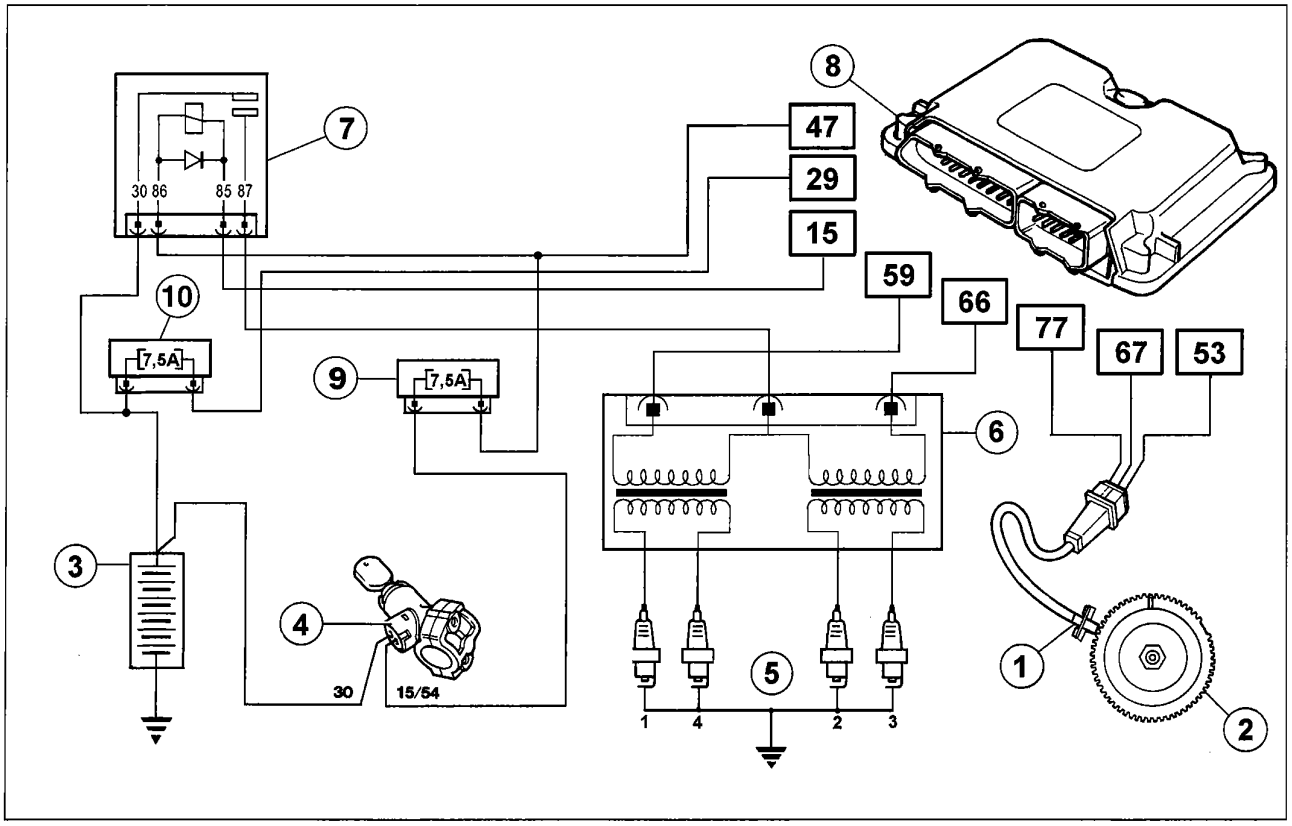


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When the voltage required for triggering an arc between the spark plug electrodes is examined, we note that voltage is high in the cylinder undergoing compression (about 10kV) while it is reduced (about 5kV) in the cylinder undergoing exhaust.

High tension distribution is static, i.e. takes place without a rotary brush and cap. This system effectively does away with a distributor. This gives the system a considerable advantage because it is known that brush and cap insulation properties play an important role. Any loss of insulation to earth may impair ignition: particularly during winter or periods of heavy rain.

The spark plugs of cylinders 1-4 and 2-3 are connected directly (in pairs) by means of high tension leads to coil secondary winding terminals and may be considered to be connected in series, because the cylinder head joins them all. This solution is also known as a "lost spark" system because the energy built up by the coil discharges almost exclusively on the electrodes of the spark plug located in the cylinder under compression to allow mixture ignition. The other spark is obviously unused because the cylinder does not contain mixture for ignition - solely exhaust gas ready for venting.




P4F11IJ01

1. Rpm and TDC sensor
2. Crankshaft pulley with phonic wheel
3. Battery
4. Ignition switch
5. Spark plugs
6. Ignition coils
7. Injection system relay
8. Electronic injection-ignition control unit
9. Injection-ignition system fuse
10. Injection-ignition control unit fuse



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### Controlling knock

This function detects the presence of knock by processing signals from relevant sensors. The ECU continually compares signals from sensors with a threshold level which is continually updated in turn to take into account background noise and engine age.

If the system detects the presence of knock, the strategy reduces the ignition advance until the phenomenon disappears. The advance is then gradually restored to the base setting or until knock recurs. Advance increases are implemented gradually, whereas reductions take place immediately.

When accelerating, a higher threshold is used to take into account increased engine noise in these circumstances.

The knock control strategy is also self-adaptive. This means that advance reductions repeated regularly are memorised in order to adjust mapping to the range of conditions experienced by the engine (use of low-octane fuel, for example). The strategy is able to restore the advance setting to the mapped level when the conditions that gave rise to the reduction cease.

## FIAT CODE IGNITION IMMOBILISER MANAGEMENT

The system features an anti-theft function. This is implemented through a special FIAT CODE control unit able to dialogue with the engine control unit, and an electronic key with a specific sender unit designed for sending an identification code.

Once the key has been turned to STOP, the FIAT CODE system de-activates the engine control unit completely.

When the key is turned to MAR, the following operations take place in sequence:

1 - the engine control unit (whose memory contains a secret code) sends the FIAT CODE a request demanding that a secret code be sent to de-activate the function lock:

2 - the FIAT CODE control unit responds by sending the secret code only after receiving a recognition code sent by the ignition key;

3 - recognition of the secret code allows the engine control unit lock to be de-activated and normal operation to proceed.

**NOTE** *Due to the presence of the FIAT CODE immobiliser,* **DO NOT TEST** *the vehicle using another engine control unit. In this case, the FIAT CODE control unit would transfer the recognition code (unknown) to the test control unit, which would thus be rendered completely unserviceable on other vehicles.*

## RADIATOR FAN MANAGEMENT

The ECU controls radiator fan operation directly according to coolant temperature and whether the air conditioning system is activated or not.

The fan comes on when the temperature exceeds 97 °C (1st speed) and 102 °C (2nd speed). The fan goes off with a hysteresis of 3 °C lower than the activation threshold.

High and low speed functions are controlled by specific relays located in the air conditioner control unit and controlled by the control unit.



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## ENGINE IDLE CONTROL

The main aim of this strategy is to maintain engine speed at around the mapped setting (warm engine: 850 rpm): the position assumed by the actuator is dependent on engine conditions/rpm and vehicle speed.

### Start-up stage

When the key is inserted, the actuator takes up a position dependent on engine temperature and battery voltage (open-loop position).

### Warming-up stage

The rpm is mainly corrected on the basis of coolant temperature.

With the engine warm, idle management is dependent upon the signal from the rpm sensor. The ECU introduces sustained idle when external loads are activated.

### Over-run

When the accelerator is released when the car is not idling, the ECU governs the actuator (step motor) by measn of special delivery curve (dash-pot curve), i.e. delays the return of the plunger to its housing to optimise the engine braking effect.

## FUEL VAPOUR RECIRCULATION MANAGEMENT

The strategy controls vapour cut-off solenoid position as follows:

- during start-up, the solenoid remains closed to prevent fuel vapours enriching the mixture excessively. This condition persists until coolant temperature reaches 65° C;
- with the engine warm, the ECU sends the solenoid a square wave signal (duty-cycle control) which modulates opening.

In this way, the ECU controls the amount of fuel vapour directed to the intake, thus avoiding substantial changes in mixture concentration.

Under the following operation conditions:

- throttle valve closed
- speed less than 1500 rpm
- intake manifold pressure less than a lower threshold calculated by the ECU on the basis of rpm level

solenoid control is inhibited with the same closure position maintained. This makes engine operation more efficient.

## TEST MANAGEMENT

Full injection-ignition system electronic testing can be achieved by connecting an appropriate device (EXAMINER or SDC station) to the test socket.

The system is also equipped with a self-diagnostic function which recognises, memorises and indicates any faults.

If sensors or actuators are found to be faulty, signal reconstruction strategies are immediately activated (recovery) so that the engine is able to operate at an acceptable level without affecting function. The car can then be driven to a service point for the necessary repairs.

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# 10.

## HEATING/VENTILATION SYSTEM MANAGEMENT

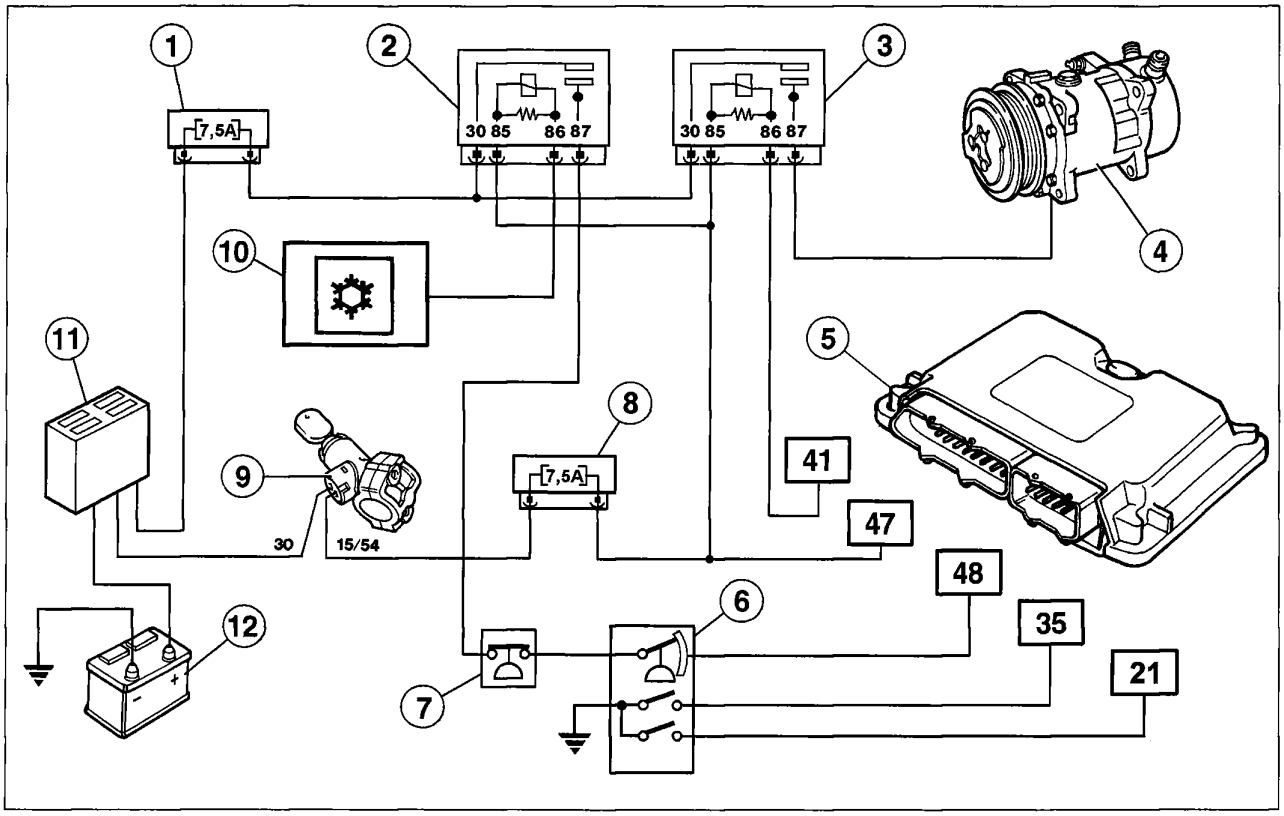
The injection-ignition control unit is connected operationally to the air conditioning system because:

1. a compressor activation request is received and appropriate action is taken (supplementary air);
2. compressor activation is enabled via pin 41, when certain pre-established conditions are satisfied;
3. information on 4-level thermostat status is received through pins 21, 35, 48 and appropriate action is taken (radiator fan activation).

With regard to point 1, if the engine is idling, the ECU increases the flow of air from the idle actuator ahead of compressor activation while the actuator is restored to normal position with a delay in relation to compressor de-activation.

With regard to point 2, the ECU automatically controls compressor de-activation:

- for a few seconds (timed de-activation):
  - during high power demands on the engine (strong acceleration)
  - engine take-off;
- as long as the following critical conditions persist:
  - for coolant temperatures in excess of a set threshold
  - for engine speeds less than 750 rpm.



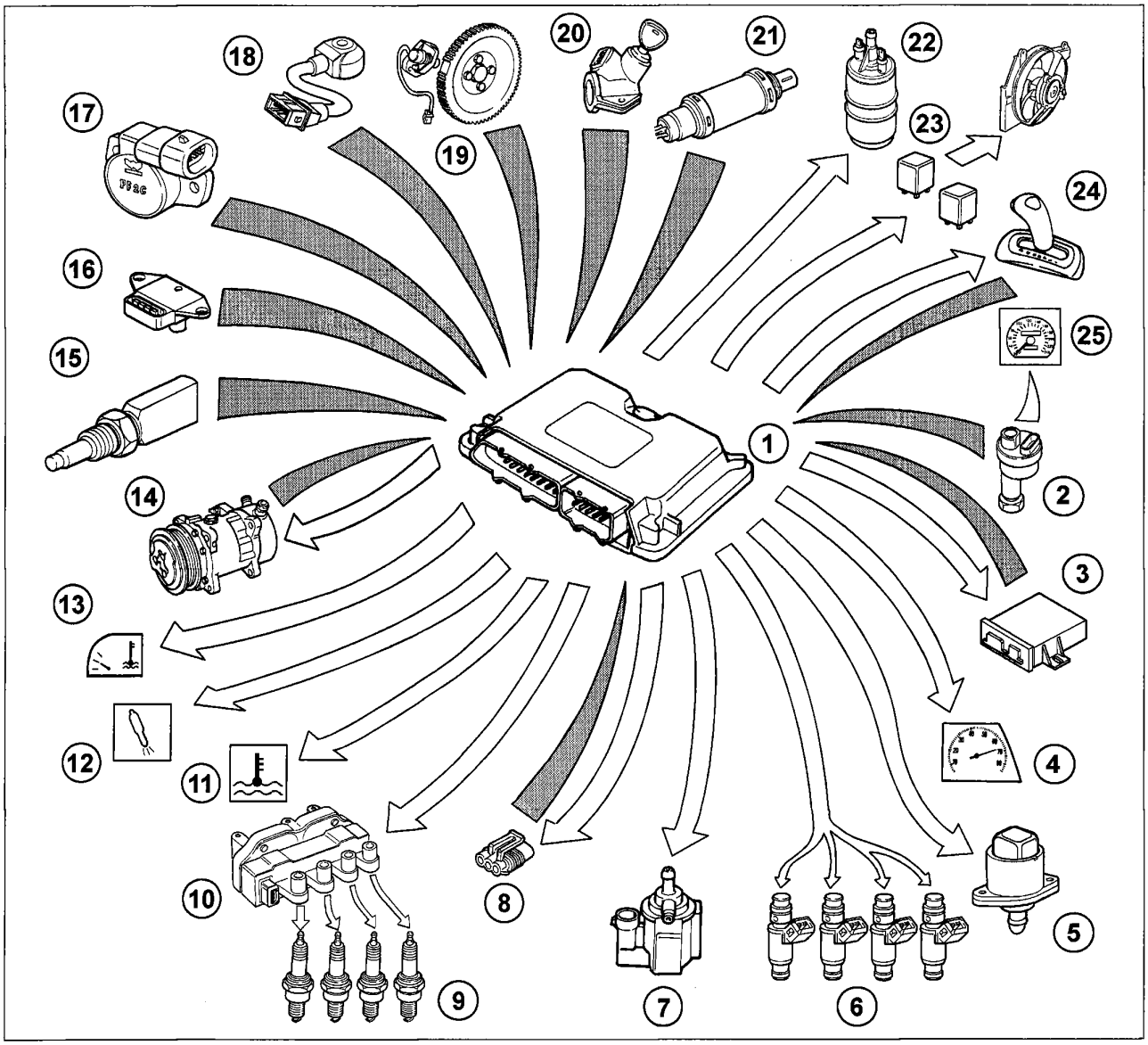

P4F14IJ01

1. Climate control system fuse
2. Heating/ventilation system relay
3. Compressor electromagnetic coupling supply relay
4. Compressor
5. Injection-ignition ECU
6. Pressure switch
7. Defrosting sensor
8. Injection-ignition control unit fuse
9. Ignition switch
10. Climate control system control unit
11. Power fuse box
12. Battery



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## DIAGRAM SHOWING INFORMATION INPUT/OUTPUT FLOWS BETWEEN CONTROL UNIT AND INJECTION-IGNITION SYSTEM SENSORS/ACTUATORS



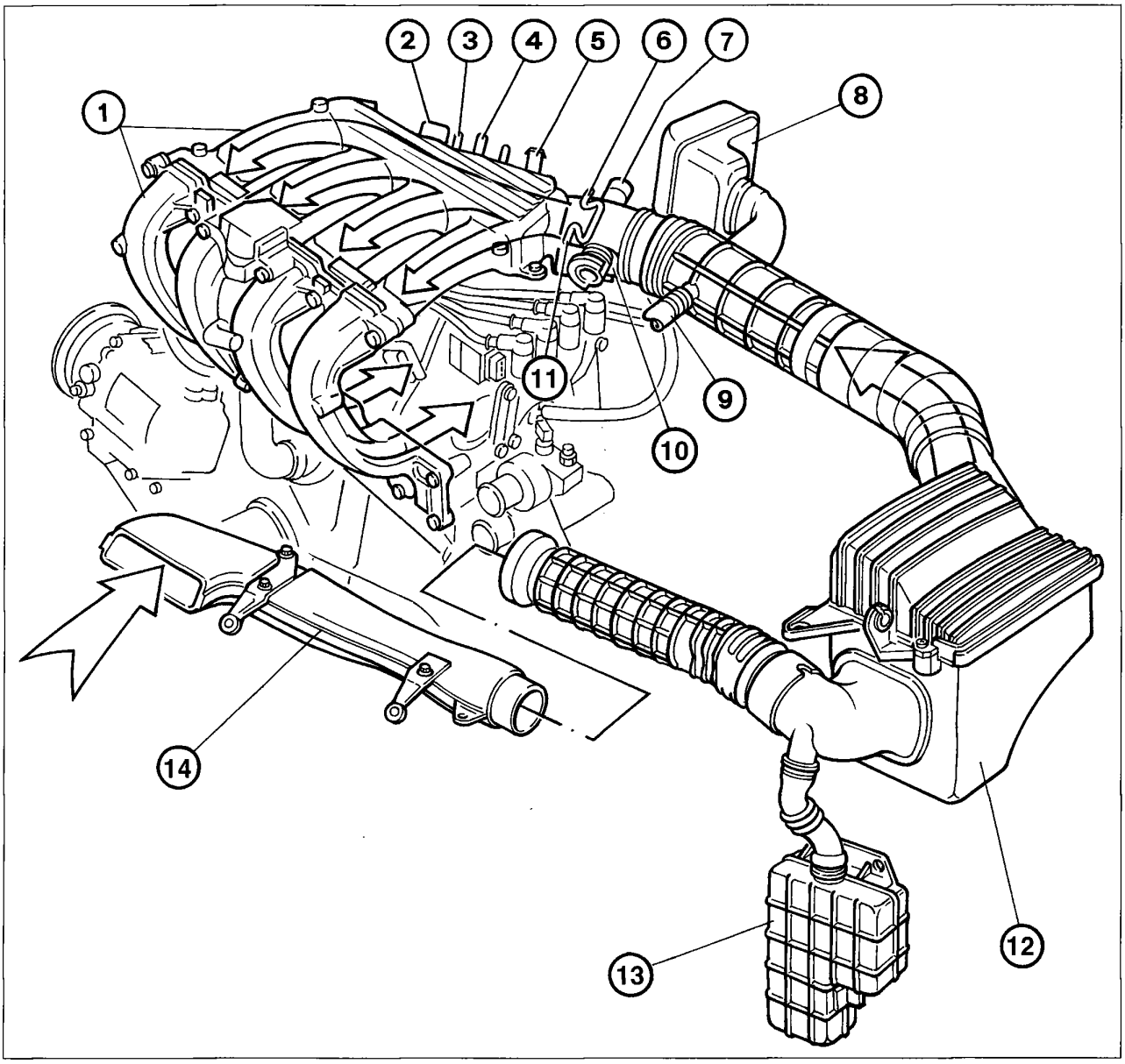

1. Electronic control unit
2. Speedometer sensor
3. FIAT CODE control unit
4. Rev counter
5. Engine idle speed actuator
6. Injectors
7. Fuel vapour solenoid
8. Diagnostic socket
9. Spark plugs
10. Ignition coils
11. Excessive coolant temperature warning light
12. Injection warning light
13. Coolant temperature gauge
14. Heating/ventilation system
15. Engine coolant temperature sensor
16. Intake air pressure and temperature sensor
17. Butterfly valve position sensor
18. Knock sensor
19. Rpm and TDC sensor
20. Ignition switch
21. Lambda probe
22. Electric fuel pump
23. Radiator fan high and low speed control relays
24. Automatic transmission
25. Speedometer / mileometer

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# 10.

## AIR INTAKE CIRCUIT MANAGEMENT




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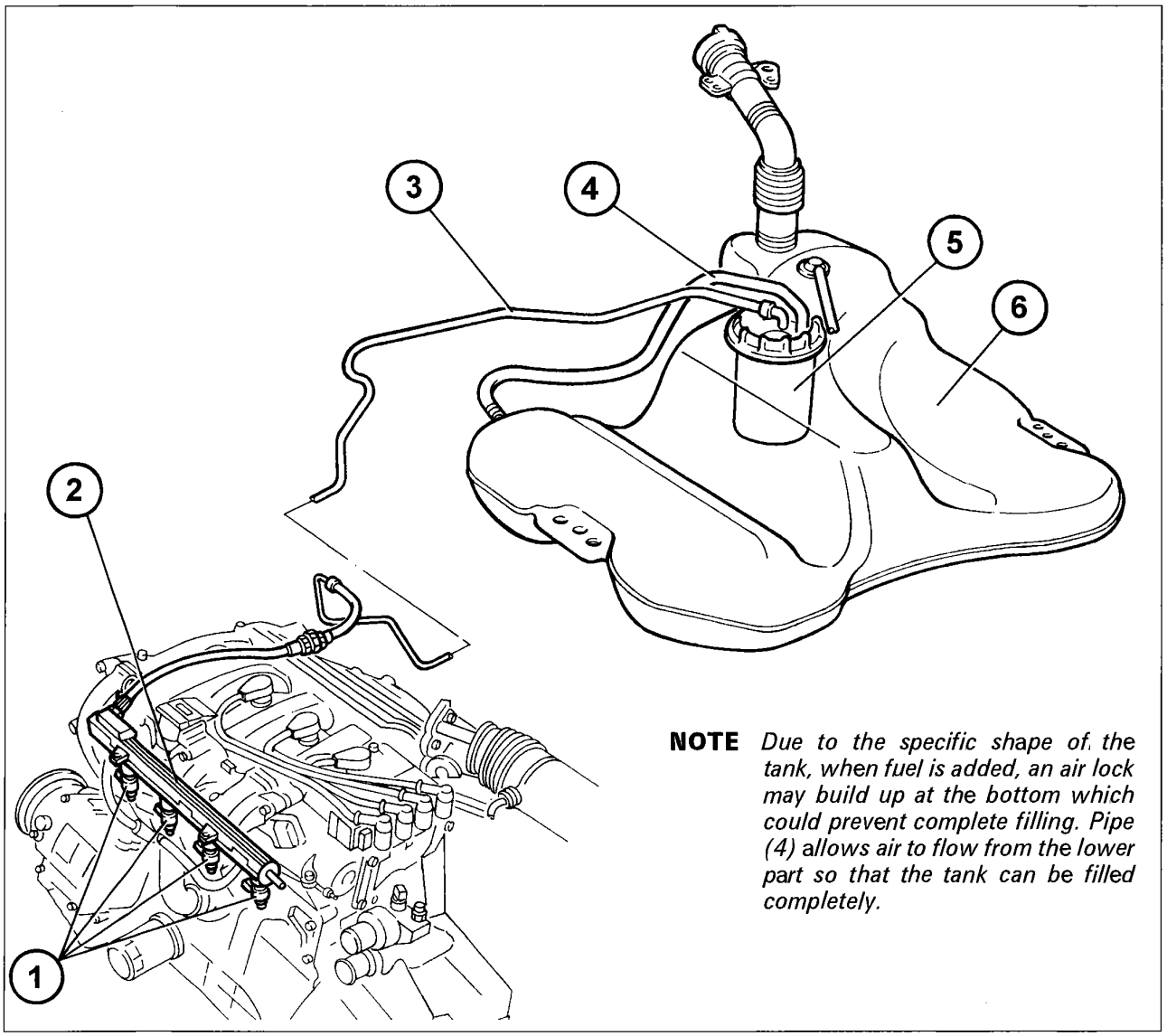
The air intake circuit consists of various parts which are responsible for carrying the amount of air required by the engine under various service conditions.

1. Inlet manifold
2. Intake air temperature and pressure sensor
3. Fuel evaporation control system point
4. Engine block gas (blow-by gas) intake for recirculation of idling exhaust gases
5. Brake servo intake
6. Attachment for engine coolant outlet pipe
7. Engine idle speed actuator
8. Upper resonator
9. Main crankcase gas intake
10. Throttle body
11. Attachment for coolant intake for heating throttle body
12. Air cleaner
13. Lower resonator
14. Inlet fitting



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## FUEL SUPPLY CIRCUIT DIAGRAM




**NOTE** *Due to the specific shape of the tank, when fuel is added, an air lock may build up at the bottom which could prevent complete filling. Pipe (4) allows air to flow from the lower part so that the tank can be filled completely.*

P4F17IJ01

1. Injectors
2. Fuel supply manifold
3. Fuel delivery line to injectors
4. Vent pipe
5. Electric fuel pump with filter and pressure regulator
6. Reservoir

Fuel is supplied to the system via an electrical pump submerged in the tank. This takes up fuel and sends it to the injectors.

The fuel feed system is returnless, i.e. only one pipe connects fuel tank and engine.
This system:

- minimises the possibility of vehicle fires in the case of an accident;
- reduces fuel vapour emissions into the atmosphere;

The electric fuel pump is enclosed in a basket. This also houses the fuel pressure regulator, fuel level gauge and fuel filter.

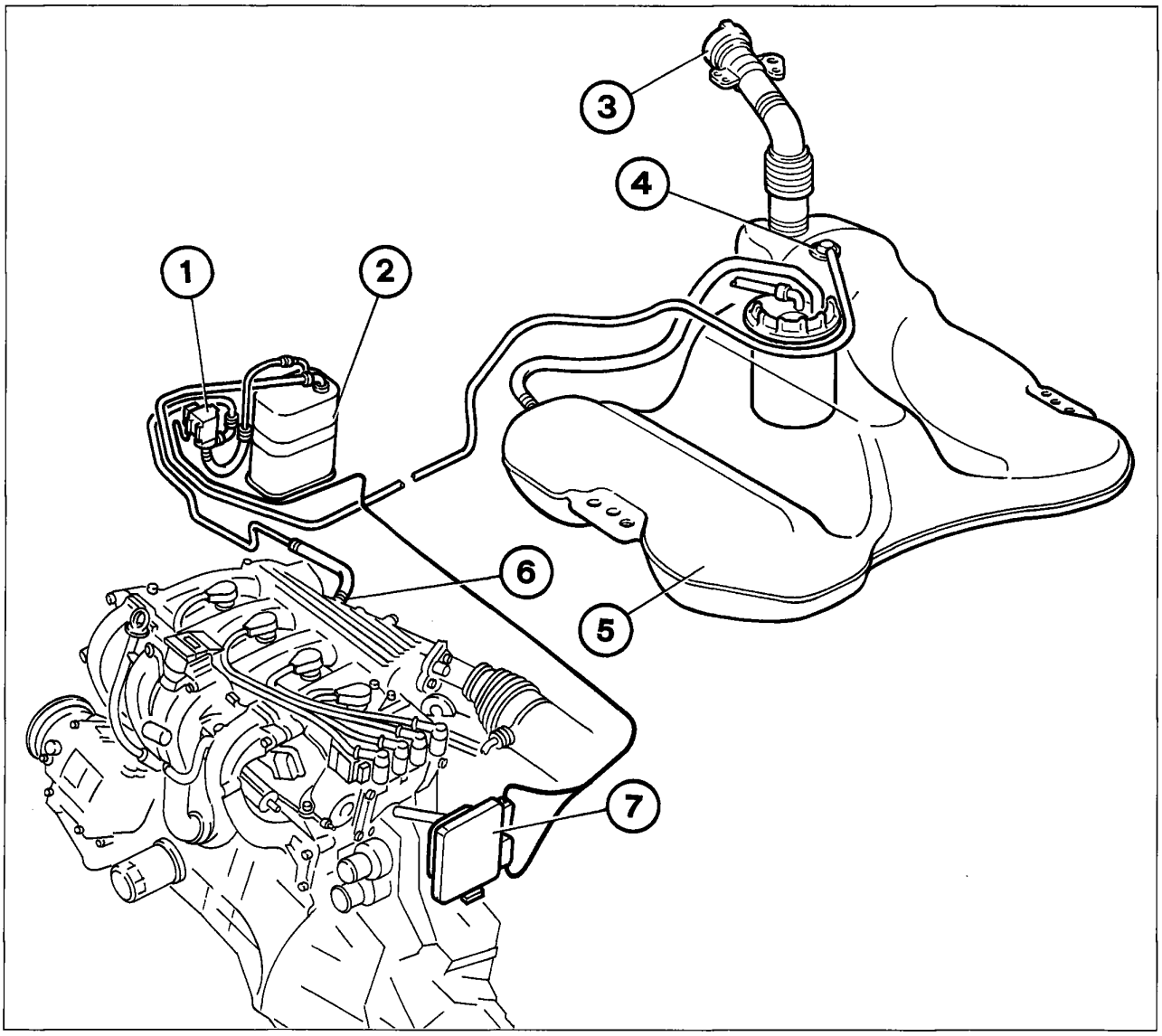
The system is also fitted with an inertia switch. This cuts off fuel flow from the electric fuel pump in the case of vehicle impact.

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# 10.

## FUEL EVAPORATION CONTROL CIRCUIT DIAGRAM




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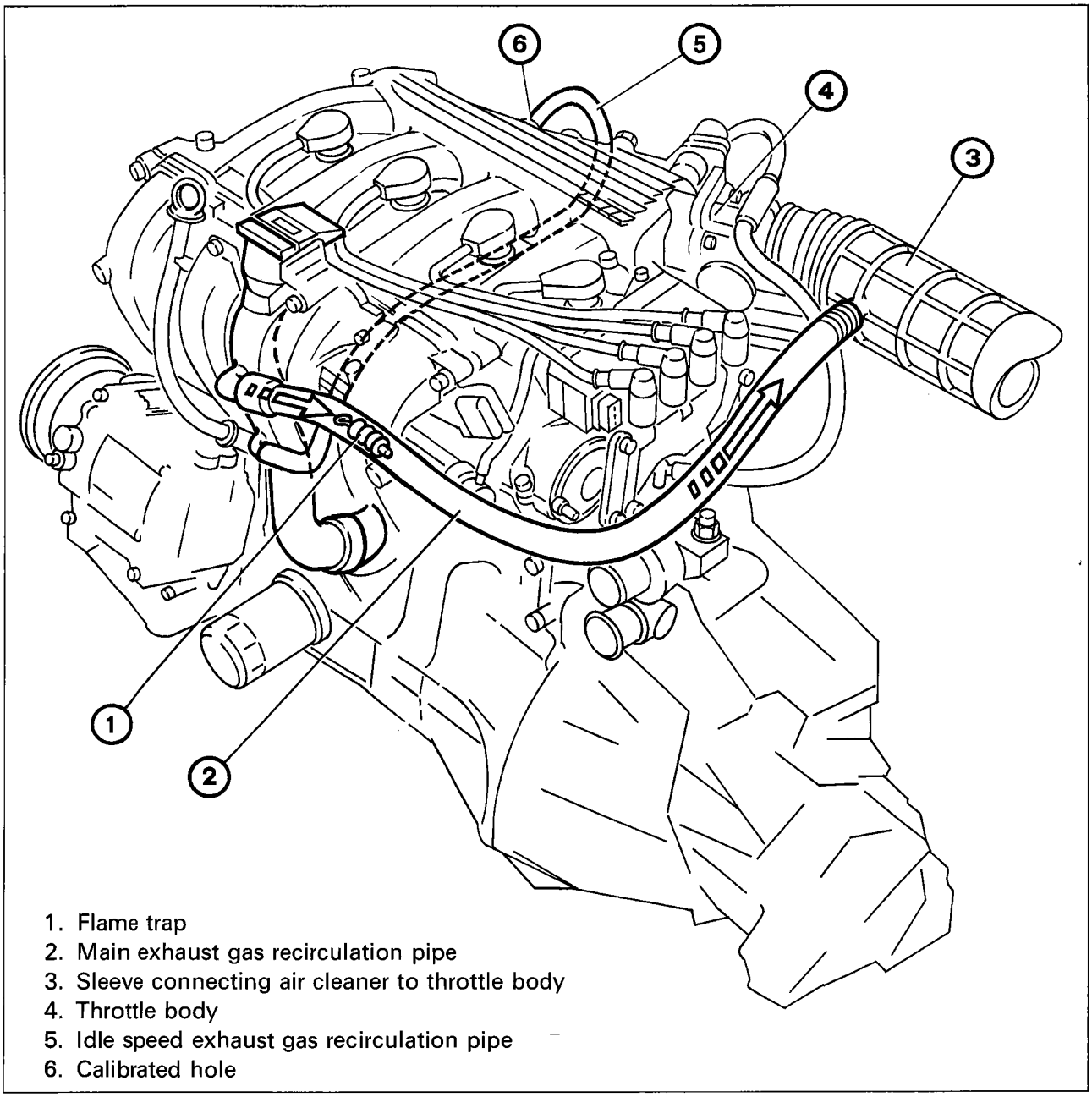
1. Fuel vapour cut-off valve
2. Active carbon trap filter
3. Safety and ventilation valve
4. Multifunction valve
5. Reservoir
6. Fuel vapour intake fitting in intake manifold
7. Injection-ignition ECU

The tank ventilation system is closed-loop type.
This system prevents fuel vapours formed in the tank and fuel system from escaping into the atmosphere and releasing their load of polluting light hydrocarbons (HC).
The system consists of a tank (5), multifunction valve (4) for controlling vapour flow, a two-way safety and ventilation valve (3) located on the fuel filler fitting, an active carbon filter (2) and a fuel vapour cut-off valve (1) controlled by control unit (7).



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## BLOW-BY GAS RECIRCULATION DIAGRAM




1. Flame trap
2. Main exhaust gas recirculation pipe
3. Sleeve connecting air cleaner to throttle body
4. Throttle body
5. Idle speed exhaust gas recirculation pipe
6. Calibrated hole

P4F19IJ01

The system controls emission, from the engine block, of vent gases made up of air-fuel mixtures, burnt gases which leak through piston rings and lubricant oil vapours by recirculating them to the intake.

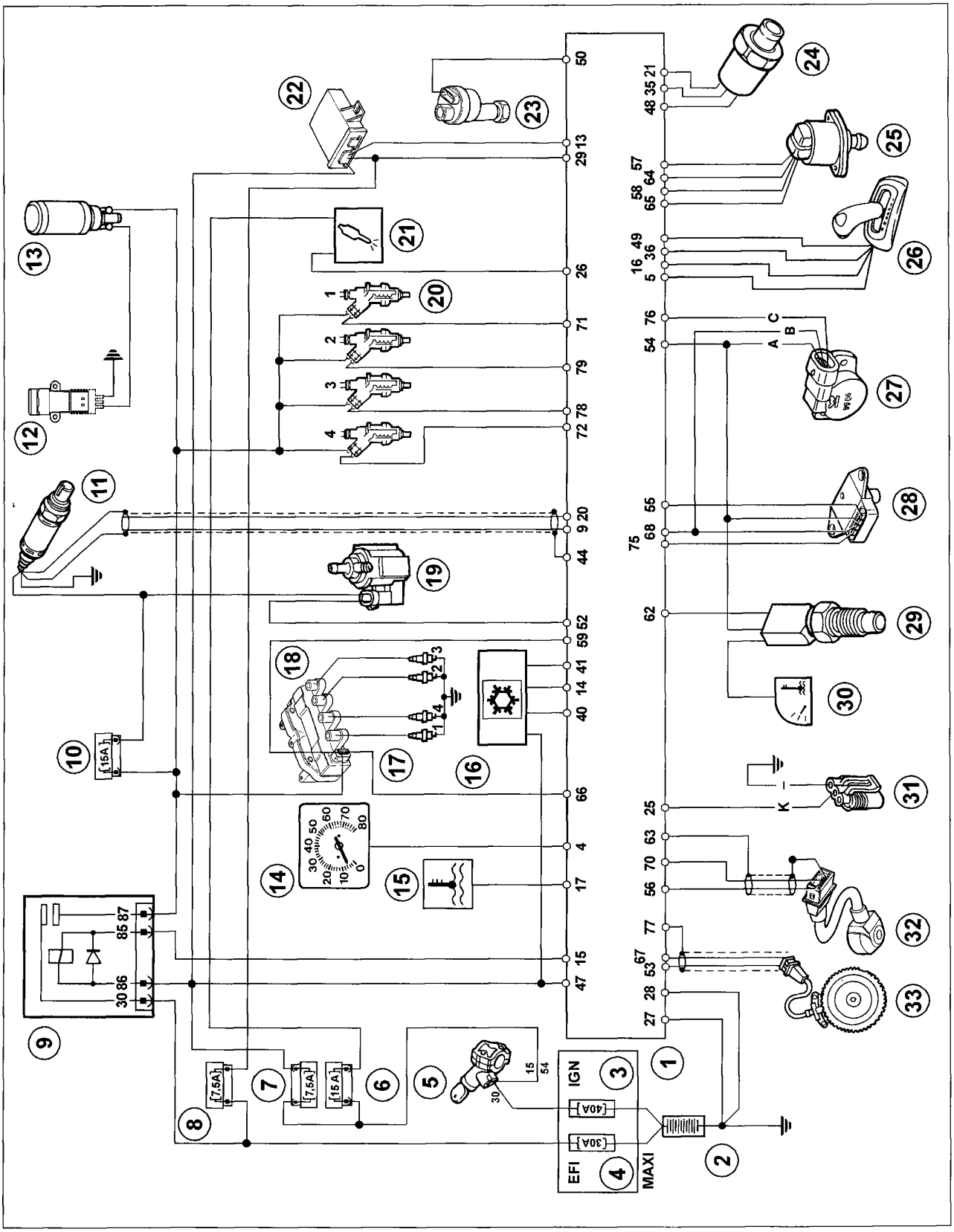
With the accelerator throttle open, vent gases from the engine block reach the sleeve connecting the air cleaner-throttle body (3) through pipe (2). This contains a flame trap (1) which prevents combustion caused by flame flashing back from throttle body (4).

With the throttle closed (engine idling), the vacuum in the intake manifold takes up gas (in limited quantities) directly through pipe (5) and calibrated hole (6).

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## INJECTION-IGNITION SYSTEM WIRING DIAGRAM






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**Key to injection - ignition system wiring diagram components**

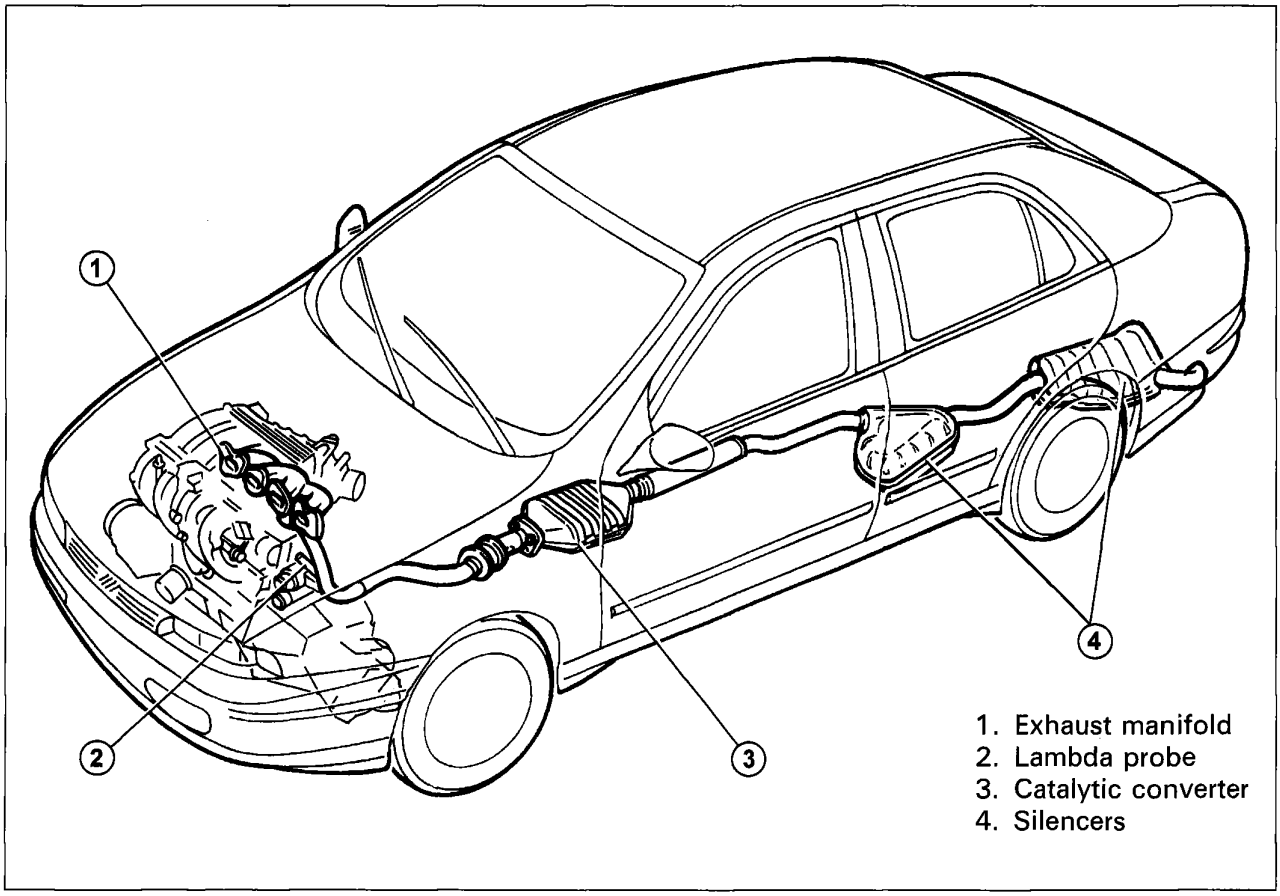
1. Electronic injection-ignition control unit
2. Battery
3. 40A master fuse for services activated by ignition key
4. 30A master fuse for injection - ignition system
5. Ignition switch
6. 15A fuse for injection system warning light
7. 7.5A fuse for various injection system components and injection ECU +15 supply
8. Injection control unit (+30
9. Fuel pump relay, lambda probe, fuel vapour cut-off solenoid, ignition coils and injectors
10. 15A fuse protecting lambda probe and fuel vapour cut-off solenoid
11. Lambda probe
12. Inertia switch
13. Electric fuel pump
14. Rev counter
15. Excessive coolant temperature warning light
16. Heating/ventilation control unit and radiator fan high and low speed control relays
17. Spark plugs
18. Ignition coils
19. Fuel vapour cut-off solenoid
20. Injectors
21. Injection - ignition system failure warning light
22. FIAT CODE control unit
23. Speedometer sensor (vehicle speed)
24. Pressure switch (four stage)
25. Engine idle speed actuator (step motor)
26. Automatic transmission ECU
27. Throttle valve position sensor
28. Intake air pressure and temperature sensor
29. Coolant temperature sensor
30. Coolant temperature gauge
31. Diagnostic socket
32. Detonation sensor
33. Rpm and TDC sensor

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# 10.

## ENGINE EXHAUST ASSEMBLY DIAGRAM




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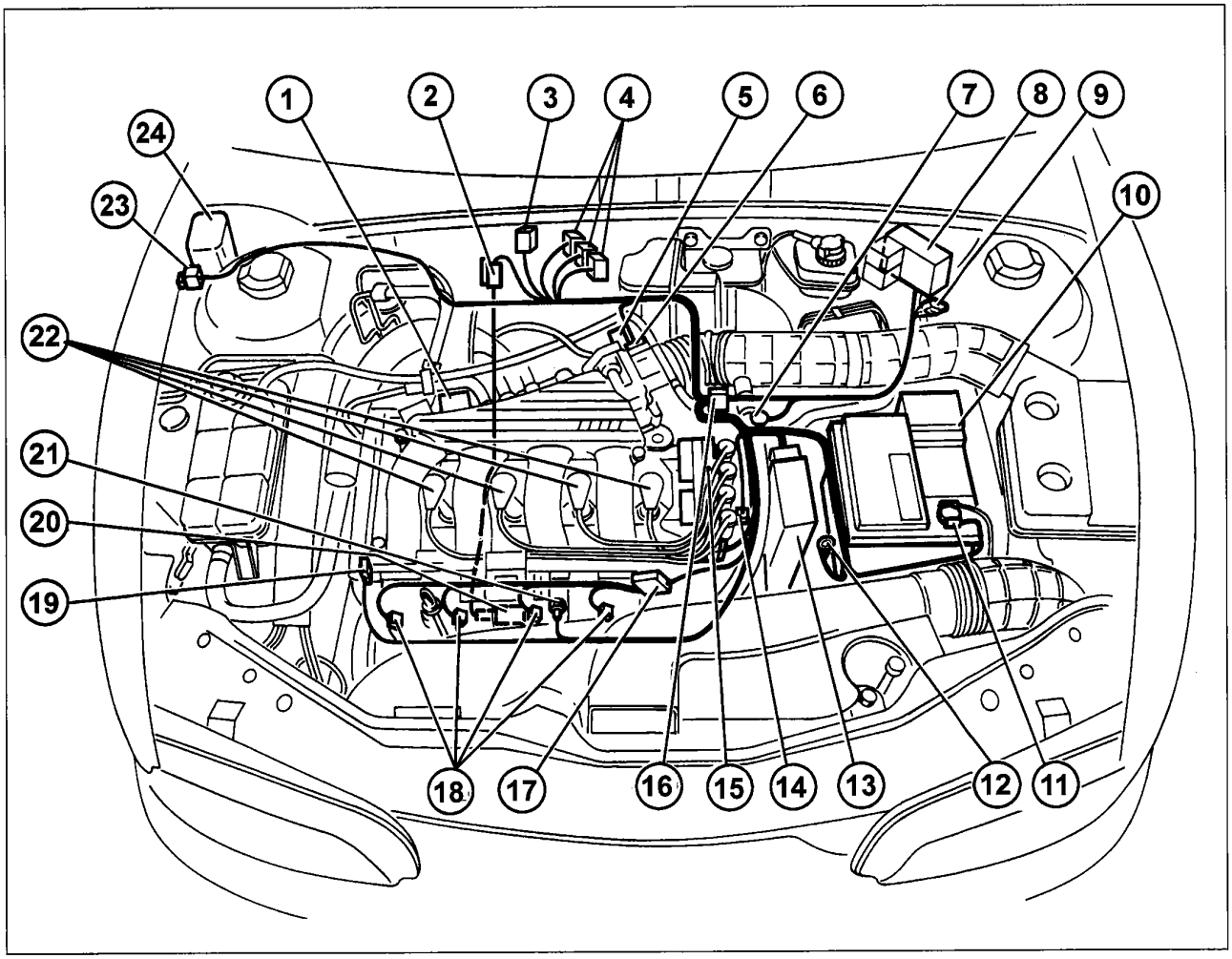
In the I.A.W. system, closed-loop mixture concentration control is activated by a lambda probe sensor. This measures the amount of oxygen in exhaust gas upstream of the catalytic converter.
The lambda probe readings allow the electronic control unit to correct the concentration continually to maintain the air/fuel ratio constant.
Harmful exhaust emissions are controlled in this way. This control is complemented by a trivalent catalytic converter.
Efficient catalytic converter operation and the ability to contain exhaust gas toxicity are dependent on the air/fuel ratio supplied to the engine.
The trivalent catalytic converter reduces the three pollutant gases present in exhaust gases simultaneously: uncombused hydrocarbons (HC), carbon monoxide (CO) and nitrogen oxides (NOx).
Two types of chemical reaction take place inside the catalytic converter:
- oxidation of CO and HC to carbon hydroxide ($CO_2$) and water ($H_2O$)
- reduction of NOx, to nitrogen ($N_2$).

The catalytic converter is put rapidly and irreparably out of action by the following:
- presence of lead in fuel. This lowers the level of conversion to levels that render the catalyst ineffective;
- presence of uncombusted fuel in the converter. A fuel flow lasting 30s in an environment at 800 °C (temperature insde the catalytic converter) is sufficient to cause melting and breakdown of the catalytic converter. It is absolutely necessary to ensure the ignition system is working properly. Therefore **the spark plugs should never be disconnected for for any reason with the engine running. When tests are carried out, the catalytic converter should be replaced with an equivalent length of piping.**



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## LOCATION OF INJECTION-IGNITION SYSTEM COMPONENTS




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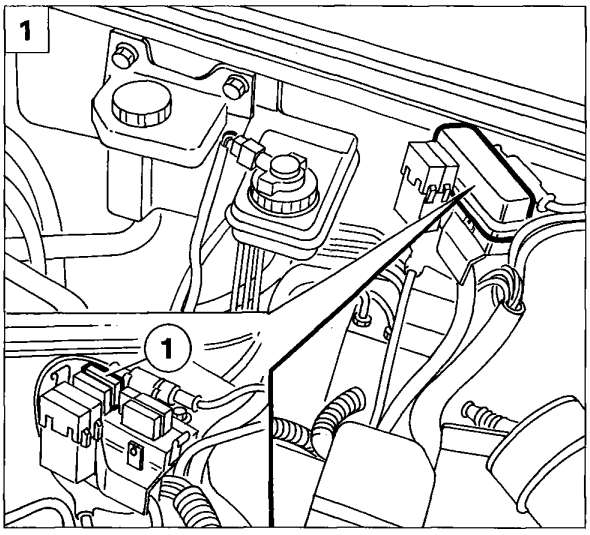
### Key to components

1 Intake air temperature and pressure sensor
2 Lambda probe coupling
3 Injection system relay
4 Protective fuses
5 Engine idle speed actuator
6 Throttle position sensor
7 Vehicle speed sensor
8 General 30A system fuse
9 Diagnostic socket
10 Battery
11 Earth on negative battery lead
12 Connection between injection earth and car body earth
13 Injection-ignition ECU
14 Coolant temperature sensor
15 Ignition coils
16 Joint between injection lead and front lead
17 Injector lead coupling
18 Injectors
19 Rpm and TDC sensor
20 Lambda probe
21 Detonation sensor
22 Spark plugs
23 Fuel vapour cut-off solenoid
24 Carbon filter

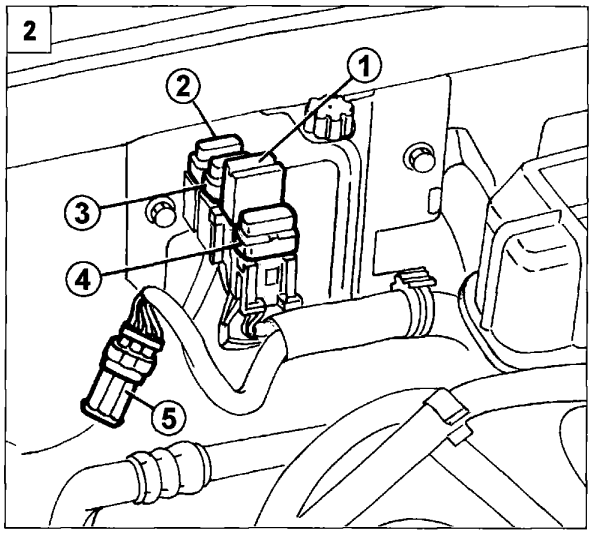
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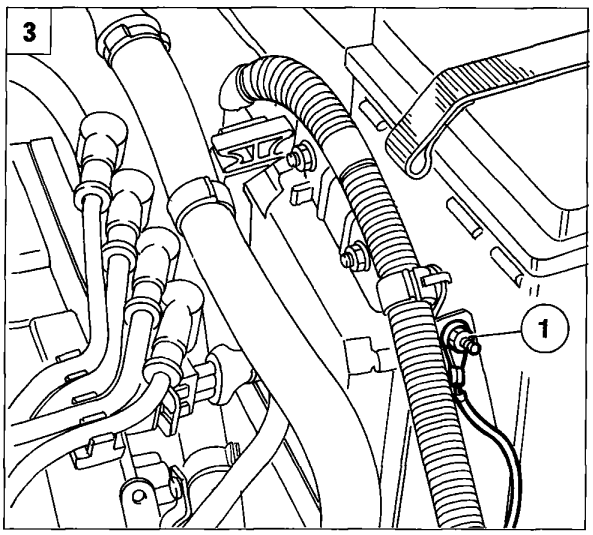
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P4F24IJ02



P4F24IJ03

## INJECTION - IGNITION SYSTEM FUSES AND RELAYS

### General system protection fuse (fig. 1)

The general fuse (30A) protecting the injection-ignition system (1) is housed inside a container; to gain access to the fuse, undo side clips and lift lid.

### Fuses and relay (fig. 2)

The following components are housed on a bracket located against the rear wall of the engine bay:

1. System relay
2. 7.5A fuse protecting +15/54 power source
3. 7.5A fuse protecting +30 power source
4. 15A fuse protecting lambda probe and fuel vapour solenoid
5. Lambda probe lead junction

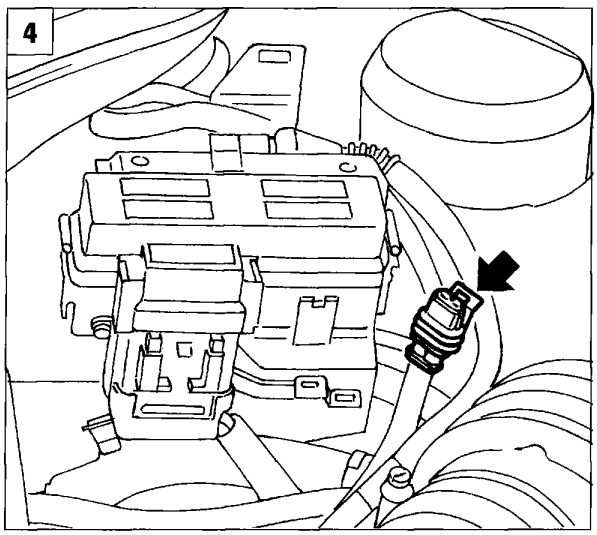
## EARTH POINTS (fig. 3)

To increse electromagnetic compatibility and functional reliability, the earth points are arranged as follows:

- The main injection-ignition system earth is directly connected to the battery negative terminal.
- The earth of the injection-ignition ECU container (1) is connected to the car body earth on the control unit bracket.

## TESTER SOCKET (fig. 4)

The test socket for connection of an SDC station or EXAMINER is located alongside the power fuse box.



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## COMPONENTS OF INJECTION-IGNITION SYSTEM

The injection-ignition system consists mainly of wiring, an electronic control unit (ECU) and the following sensors and actuators:

**Sensors**

- Rpm and TDC sensor
- Knock sensor
- Throttle position sensor
- Coolant temperature sensor
- Intake air temperature and pressure sensor
- Vehicle speed sensor
- Lambda probe

**Actuators**

- Engine idle speed actuator
- Electric fuel pump
- Fuel vapour cut-off valve
- Injectors
- Ignition coils

## INJECTION-IGNITION SYSTEM WIRING

The various system components are connected by a single wiring system fitted with connectors of various types. These are grouped in special ducts fitted to the engine (prewiring).

## INJECTION-IGNITION ECU

The injection - ignition system control unit adopted is specific to this version. It is connected to the electrical wiring by two connectors. These are 52 pin (upper connector) and 28 pin (lower connector) respectively.

This digital, microprocessor unit features high computing capacity and is accurate, reliable and versatile. It consumes little energy and is maintenance-free.

The ECU's task is to process signals from the various sensors through the application of software algorithms and control the actuators in order to achieve optimal engine performance.

Essential features of the electronic control unit are as follows:

- Data acquisition and coding section
- Microprocessor
- ROM memory
- RAM memory
- EEPROM memory
- Drivers

a. **Data acquisition and coding section**

This consists of a set of electronic components (A/D converters) designed to receive data in the form of analogue electrical signals. Inside, the signals are converted into digital signals, processed and stored.

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**b. Microprocessor**

This electronic component is responsible for computing and managing acquired data. It is thus a true computer and its main tasks include: consulting memories, comparing data input with sample data, managing actuator control circuits.

**c. ROM memory (Read Only Memory)**

This contains all programs necessary for microprocessor operation. Because the unit is programmed permanently prior to installation, data may be read but not modified.

The ROM memory is conservative; commands are saved even when the battery leads are disconnected.

**d. RAM memory (Random Access Memory)**

The RAM memory is a transitional memory where data can be read and saved.

This memory is actually used to save input data temporarily so that they are available for processing and also to memorize signals for coding operating anomalies that may occur within sensors, actuators or ECU functions.

The RAM memory is divided into sections: the first volatile part, for data memorization, is enabled with ignition key in MARCIA position and deleted in STOP position.

The second non-volatile part, (RAM STAND-BY) is used to store self-adaptive corrections made to idle speed opening, idle speed actuator and throttle valve angular position when the throttle is fully closed. It also saves engine parameters and adapts them in time. In other words, the ECU uses the Lambda probe signal to modify and store an injection time correction factor that influences mixture concentration.

For self-adaptive idle speed actuator corrections to be maintained, they require a continuous supply from the battery.

If the battery, dual relay or terminals are disconnected, the parameters are zeroed. Normal vehicle use resets the adaptation process and new parameters are memorized.

**e. EEPROM memory (Electrical Erasable Programmable Read Only Memory)**

his is a special type of memory that can be deleted electrically and reprogrammed again and again. One of its functions is to receive from the RAM STAND-BY recordings of anomalies that have arisen during engine operation and send these through the diagnostic socket to a Fiat-Lancia Tester. A Fiat-Lancia Tester must be used in active diagnosis in order to delete the anomalies.

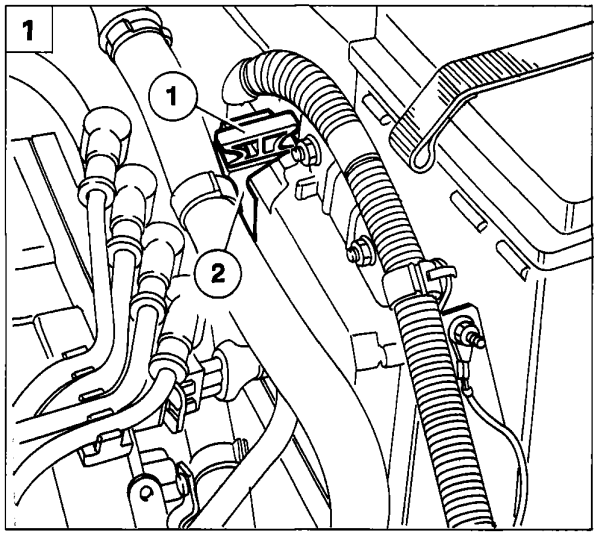
The presence of a non volatile memory allows data relating to system anomalies to be saved even if the battery is disconnected and anomalies to be indicated even once they have been disappeared.

**f. Drivers (final power stages for actuator control)**

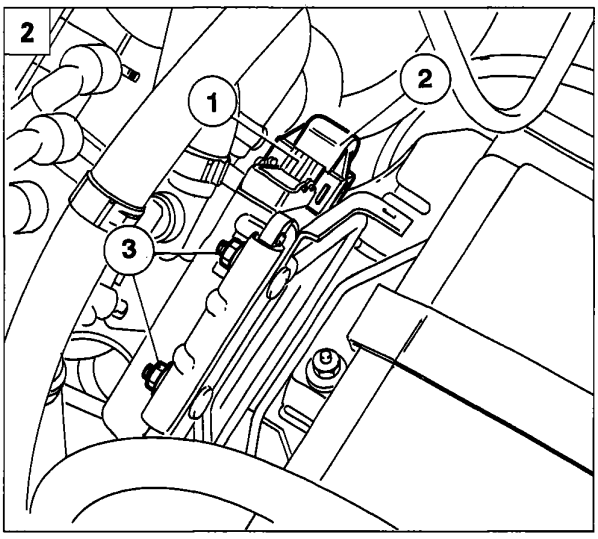
These circuits are driven directly by the microprocessor and the relevant integrated circuit. They are used to supply actuators such as: injectors, motor for idle control, fuel vapour cut-off valve and fuel pump relay.



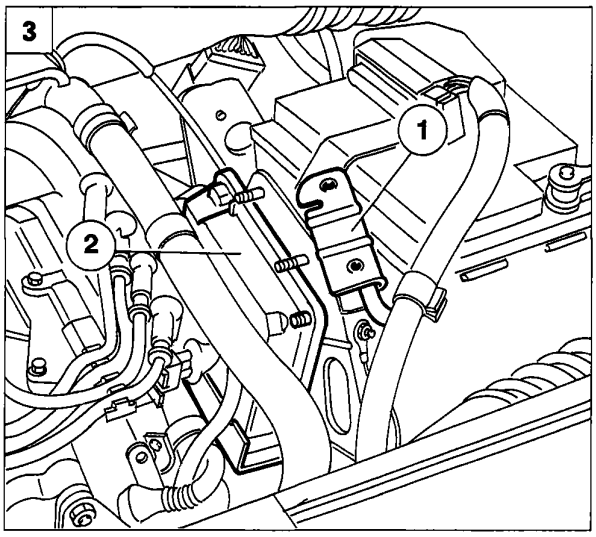
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P4F27IJ02



P4F27IJ03

### Removing-refitting

1. Lift up lock (1) and disconnect upper connector (2).
2. Pull down lock device (1) and disconnect lower connector (2) then undo retaining nuts (3).
3. Disconnect bracket (1) and remove, then remove the injection-ignition control unit (2).

*It is absolutely prohibited to exchange injection control units between different vehicles in order to check their efficiency.*

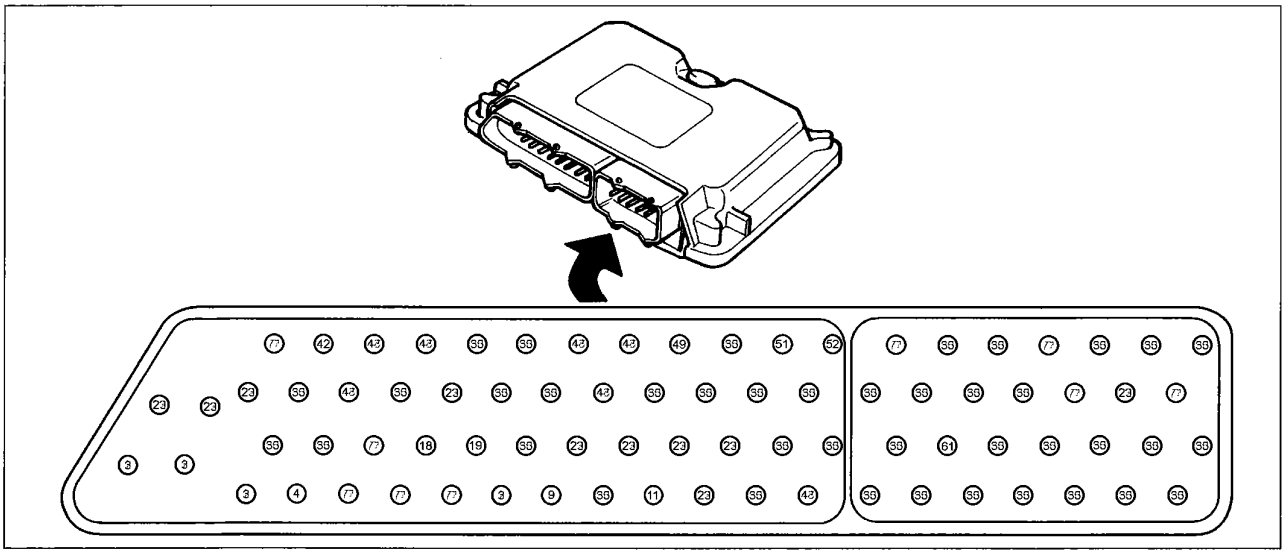
*Before replacing an ECU as a result of testing, ensure it is really faulty because when a new ECU is activated, the secret Fiat CODE system code is memorised and this makes the unit completely unusable on other vehicles.*

*Unconnected pins may be live. Do not connect anything because this could lead to short-circuits and damage to the control unit.*
*Fit and remove the multiple connector with the ignition key removed.*



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**Identifying connections on injection-ignition control unit (pin-out)**

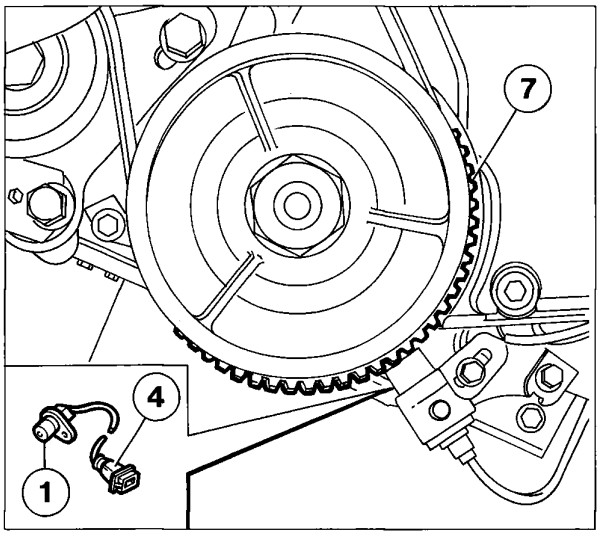


P4F28IJ01

1-3. Not connected
4. Rev counter signal
5. Automatic transmission ECU (coolant temperature signal)
6-8. Not connected
9. Lambda probe (negative)
10-12. Not connected
13. FIAT CODE control unit
14. Radiator fan high speed control (versions with air conditioner)
15. Injection system relay enablement
16. Automatic transmission ECU (throttle valve angle)
17. Excessive coolant temperature warning light
18-19. Not connected
20. Lambda probe (positive)
21. 4-stage pressure switch
22-24. Not connected
25. Diagnostic socket (K line)
26. Injection system warning light
27-28. Earth
29. Fused power source (+30)
30-34. Not connected
35. Radiator fan low speed activation request signal
36. Automatic transmission ECU (torque reduction signal)
37-39. Not connected
40. Radiator fan low speed control (versions with air conditioner)
41. Air conditioner compressor relay
42-43. Not connected
44. Lambda probe lead shielding
45-46. Not connected
47. Power source (+15)
48. Air conditioner activation request
49. Automatic transmission ECU (gear change signal)
50. Vehicle speed signal
51. Not connected
52. Fuel vapour solenoid
53. Rpm sensor (positive)
54. Earth for coolant temperature, air pressure/temperature and throttle valve position sensors.
55. Inlet air temperature
56. Knock sensor (positive)
57. Engine idle speed actuator
58. Engine idle speed actuator
59. Ignition coils (cylinders 1-4)
60. Throttle valve position sensor power source
61. Not connected
62. Coolant temperature sensor (positive)
63. Knock sensor lead shielding
64. Engine idle speed actuator
65. Engine idle speed actuator
66. Ignition coils (cylinders 2-3)
67. Rpm sensor (negative)
68. Intake air pressure/temperature sensor power source
69. Not connected
70. Knock sensor (negative)
71. Cylinder no. 1 injector
72. Cylinder no. 4 injector
73-74. Not connected
75. Intake air pressure signal
76. Throttle valve position sensor
77. Rpm sensor lead shielding
78. Cylinder no. 3 injector
79. Cylinder no. 2 injector
80. Not connected



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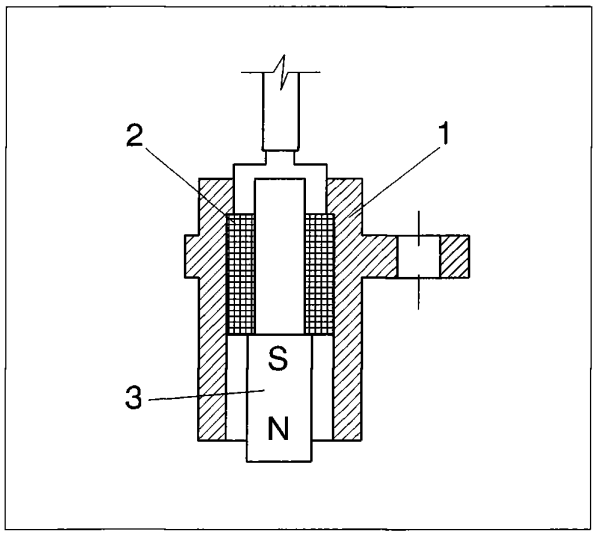

P4F29IJ01

## RPM AND TDC SENSOR (Jaeger CVM02)

RPM and crankshaft angular position reference (TDC indicator) sensor (1) is secured to the engine block facing phonic wheel (7) located on the crankshaft pulley.

### Principle of operation

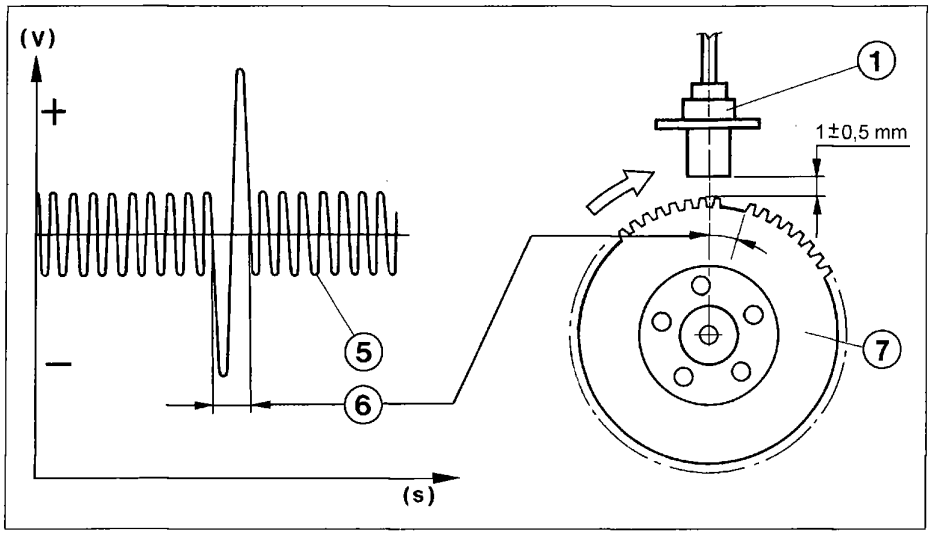
This consists of a tubular case (1) containing a permanent magnet (3) and an electrical coil (2).The magnetic flux set up by magnet (3) undergoes fluctuations due to changes in the gap as the teeth pass in front of the phonic wheel.




P4F29IJ02

These magnetic flux changes set up an electromotive force in coil (2). An alternating positive (teeth facing sensor) and negative (gap facing sensor) voltage is set up at coil terminals. The sensor output voltage peak value depends on the gap beteween sensor and phonic wheel teeth if all other factors are equal.

Two of the sixty teeth on the phonic wheel are removed to create a reference gap. Gear pitch therefore corresponds to an angle of 6° (360° divided by 60 teeth). The synchronism point is recognised at the end of the first tooth following the space left by the two missing teeth. When this gap passes beneath the sensor, engine piston pair 1-4 is located at 114° before TDC.



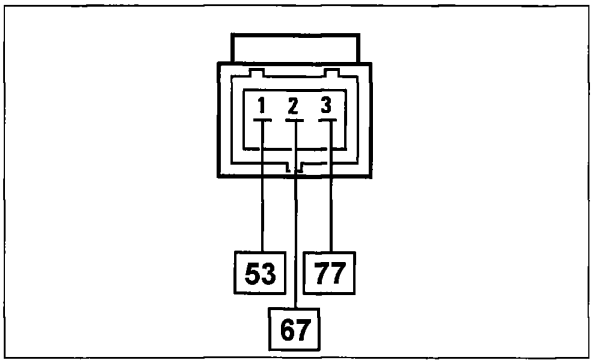

P4F29IJ03

1. Sensor
2. Winding
3. Permanent magnet
4. Sensor connector
5. Output signal
6. Signal corresonding to the two missing teeth
7. Crankshaft pulley with phonic wheel



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# 10.



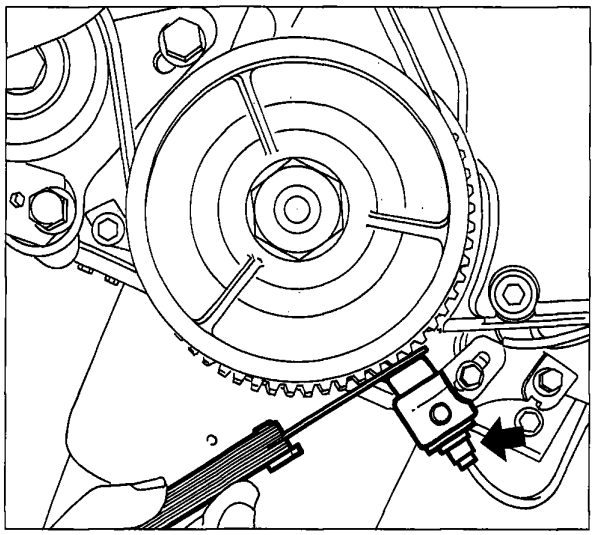

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### Wiring connector

The sensor is connected to the ECU by means of twisted wires covered by a shielded, interference-proof sheath.

Pin 1 - Signal
Pin 2 - Earth
Pin 3 - Shielding

**NOTE** *The numbers in boxes indicate corresponding control unit pins.*



P4F30IJ02

### Removing-refitting

Disconnect electrical connection.

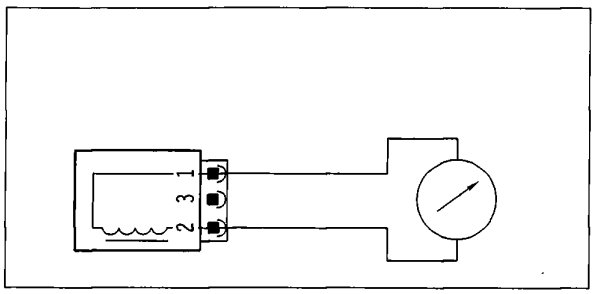
Unscrew the screw indicated and remove the sensor.

### Checking gap

Check gap between sensor and phonic wheel teeth.

**Gap: 0.5 - 1.5 mm**

**NOTE** *Whenever repairs to the rpm and TDC sensor mount are necessary (e.g. gap not as specified, sensor not aligned etc.), the sensor must be positioned and aligned with the mount as described in the engine service manual (publication no. 504.589/20).*




P4F30IJ03

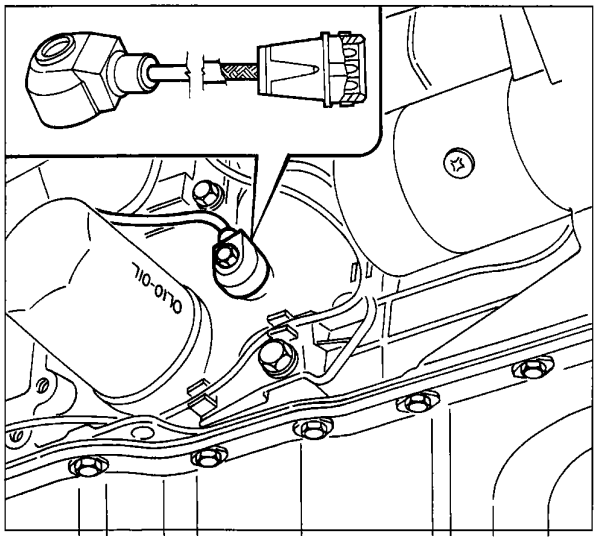
### Checking resistance

Sensor resistance may be measured by disconnecting the connector and connecting an ohmmeter to the sensor terminals.

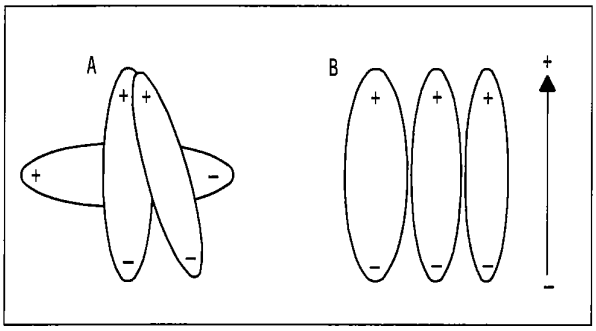
**Resistance 1134 - 1386 ohm at 20 °C**



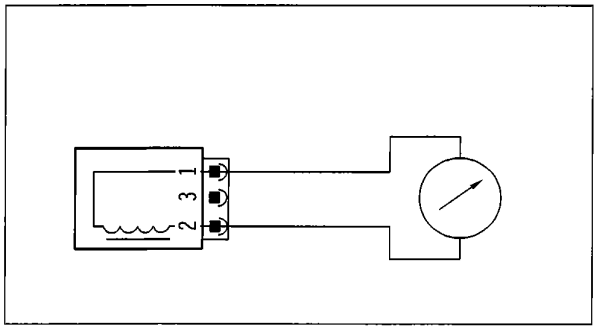
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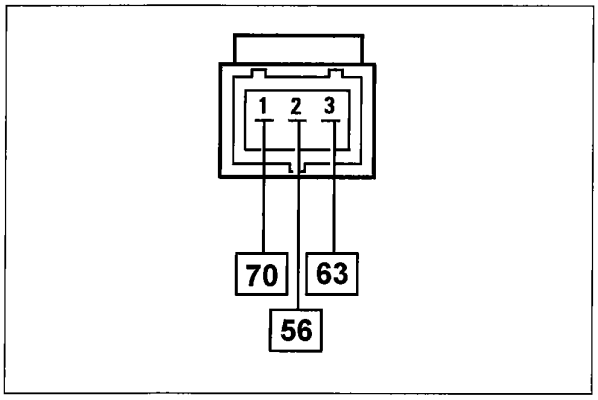

P4F31IJ01




P4F31IJ02




P4F30IJ03




P4F31IJ03

## KNOCK SENSOR (KNE-03)

This piezo-electric sensor is fitted to the engine block in a symmetrical position in relation to cylinder pairs 1-2 and 3-4.

This positioning is necessary in order to detect the onset of knock in all cylinders equally.

When the engine knocks, vibrations of a specific frequency are set up in the engine block. This effect has a mechanical effect on a piezo-electric crystal, which sends a signal to the control unit. The control unit processes the signal and reduces ignition advance until the phenomenon disappears. Advance is then gradually restored to original values.

### Principle of operation

Quartz crystal molecules possess electrical polarity.

The molecules are not oriented in any particular direction when at rest (A).

When the crystal is subject to pressure or impact (B), it takes up a different position. The entity of the change is proportional to the pressure to which the crystal is subjected. The positioning induces a voltage at the crystal terminals.

A. Rest position

B. Position when under pressure

### Checking resistance

Sensor resistance may be measured by disconnecting the connector and connecting an ohmmeter across the sensor terminals.

**Resistance 532 - 588 ohm at 20 °C**

### Wiring connector

The sensor is connected to the control unit by mean of twisted wires and covered with a shielded anti-interference sheath.

Pin 1 - Earth
Pin 2 - Signal
Pin 3 - Shielding

The numbers in boxes indicate the corresponding control unit pins.

### Removing - refitting

Disconnect electrical connection, unscrew screw retaining the knock sensor and remove.



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# 10.

## THROTTLE BODY (46 SXF 2)

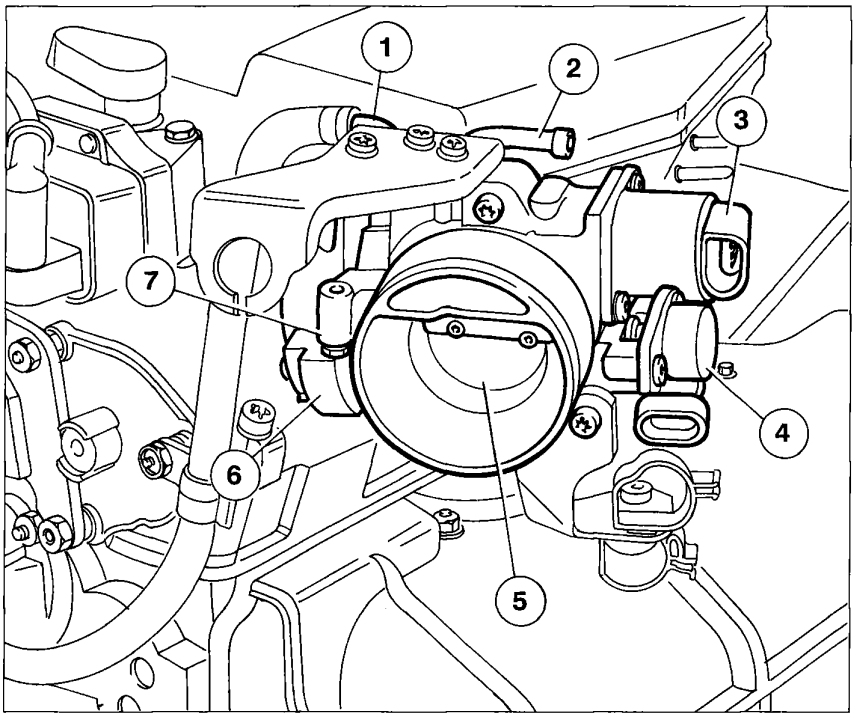
The throttle body is responsible for metering the quantity of air supplied to the engine (and thus controlling engine power output) according to accelerator position determined by the driver.

The throttle body is fastened to the intake manifold by four screws. The throttle is opened by a linkage with configuration designed to open the throttle by a small amount when the pedal is hardly pressed (provided pedal travel remains the same) and open it by large amounts when the pedal is pressed down further.

With the pedal fully released (engine in over-run or idling), the additional air required is supplied by an engine idle adjustment solenoid. Under these conditions, the throttle opening lever comes into contact with an anti-bind screw, which prevents the throttle becoming locked in closed position.

To prevent the build-up of ice around the throttle and the hole leading to the PCV valve, the throttle body is heated by directing a small amount of coolant from the engine thermostat around a chamber inside the case.

The throttle position sensor and engine idle speed actuator are also fitted on the butterfly valve case.



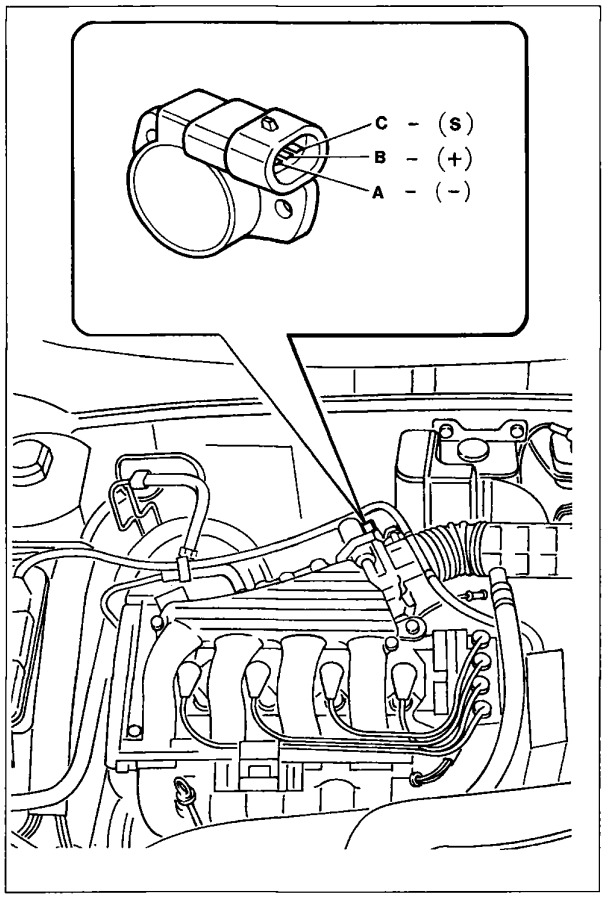

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*The anti-bind screw is set by flushing in the factory and should never be tampered with.*

1. Attachment for engine coolant delivery hose
2. Attachment for engine coolant return hose
3. Engine idle speed actuator
4. Throttle position sensor
5. Throttle valve
6. Throttle linkage
7. Throttle valve adjustment and antibind screw (do not touch)



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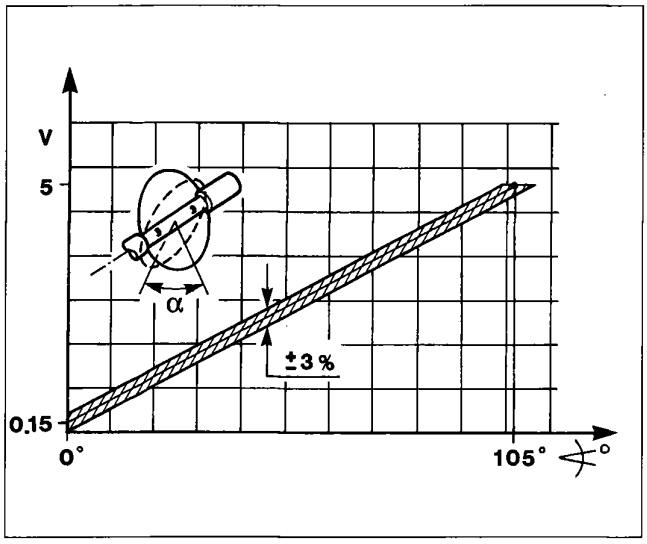
## THROTTLE VALVE POSITION SENSOR (IPF-2C)

This takes the form of a potentiometer whose mobile part is controlled by the butterfly valve spindle.

The potentiometer is fitted inside a plastic container equipped with two tabs containing two UNSLOTTED holes. These anchor the sensor and ensure it is positioned correctly in relation to the throttle valve. A three-pin socket (ABC) on the container provides an electrical connection with the injection-ignition ECU.

During operation, the ECU supplies the potentiometer at a voltage of 5 Volt. The parameter measured is throttle position from idle to full opening for injection control management.

The following graph indicates the voltage level supplied by the sensor as a function of throttle opening angle.




P4F33IJ02

The ECU recognises throttle valve opening status on the basis of outlet voltage and corrects mixture concentration accordingly.
When the throttle is closed, an electric voltage signal is sent to the ECU, which recognises idle and cut-off status (discerning between them on the basis of rpm level).

The potentiometer is linear (single-ramp): its main specifications are as follows:

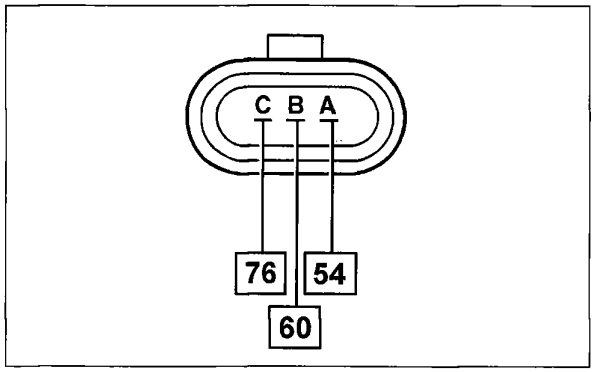
Effective electrical angle: 90° ± 2°

Total mechanical travel: 110° ± 8°

Temperature service range: –30°C - +125°C



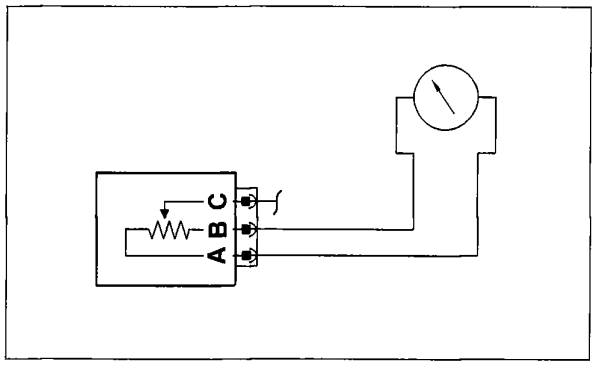
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### Wiring connector

The numbers in boxes indicate the corresponding control unit pins.
Pin A - Earth
Pin B - Positive
Pin C - Signal




P4F34IJ02

### Checking resistance

Sensor resistance may be measured as follows

- by connecting an ohmmeter across sensor pins A and B to check fixed resistance is 1200 ohms;
- by connecting an ohmmeter across sensor pins A and C and checking that resistance changes from 0 to 1200 ohm ±20%. when the throttle valve is moved.

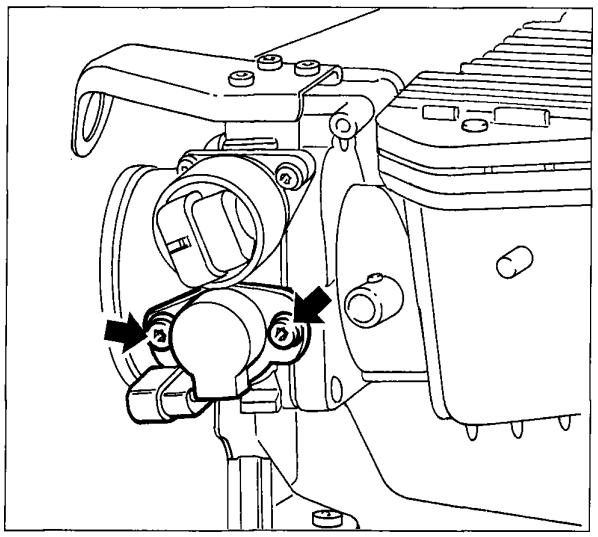
### Recovery

A value calculated on the basis of rpm and intake manifold pressure is assumed. If the pressure sensor also fails, a throttle opening angle of 50° is adopted as a fixed value.

The strategy of gradually decreasing rpm when idling (dashpot) is blocked.

Idle self-adaptation is blocked.

Mixture concentration self-adaptation is blocked.



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### Removing-refitting

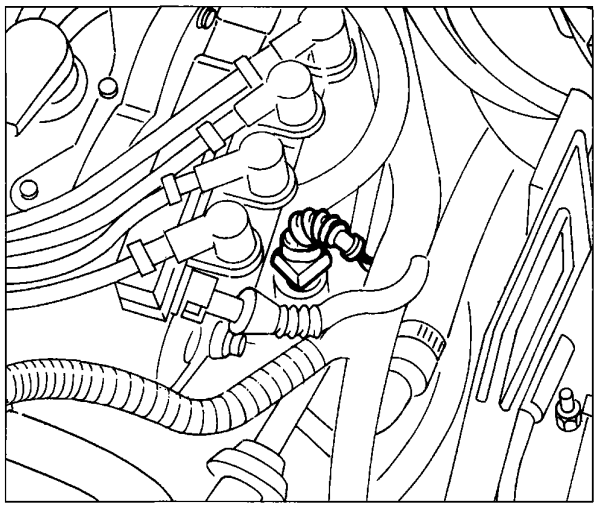
Disconnect electrical connection, unscrew both retaining screws and remove the sensor.

**NOTE** *The potentiometer is fitted to the throttle body by two tabs containing two unslotted holes. No angular position adjustment is therefore necessary because the control unit uses its own self-adaption software to detect whether the throttle is fully open or fully closed.*

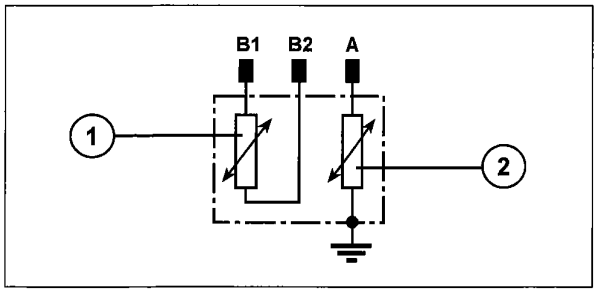
**NOTE** *Fit new potentiometer retaining screws each time they are removed because the thread is covered by a light coat of loctyte. This ensures a seal once only.*



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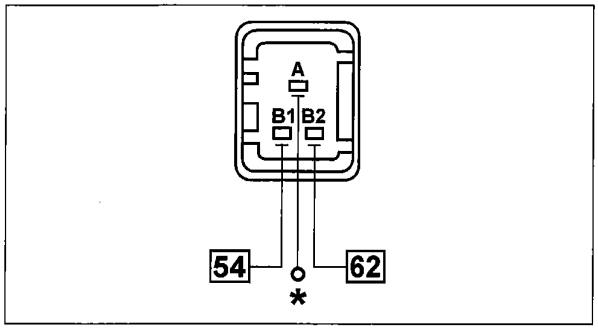

P4F35IJ02

**NTC INJECTION**

| °C | Ω | °C | Ω |
|---|---|---|---|
| -20 | 15970 | 40 | 1150 |
| -10 | 9620 | 50 | 807 |
| 0 | 5975 | 60 | 576 |
| 10 | 3816 | 70 | 418 |
| 20 | 2500 | 80 | 309 |
| 25 | 2044 | 90 | 231 |
| 30 | 1679 | 100 | 176 |

**INSTRUMENT NTC**

| °C | Ω |
|---|---|
| 60 | 512-602 |
| 90 | 184-208 |
| 120 | 76-88 |




P4F35IJ03

* Connection to coolant temperature gauge on instrument panel

## ENGINE COOLANT TEMPERATURE SENSOR
**(Jaeger 402.183.01)**
**(Elth 2690350)**

The sensor is fitted to the thermostat case. It consists of a brass case, which protects the actual resistance element: two NTC thermistors (standing for Negative Temperature Coefficient because sensor electrical resistance decreases in inverse proportion to temperature).
The two NTC unuts are separate and send temperature information to a special indicator on the instrument panel and to the injection-ignition control unit.
The reference voltage is 5V for the injection system NTC element; since this circuit is designed as a voltage divider, the voltage is distributed between a resistance present in the ECU and the sensor N.T.C. resistance. The ECU is therefore able at any moment to assess sensor resistance changes through voltage changes and thus obtain information on intake air temperature.
1. NTC for injection system
2. NTC for indicator on instrument panel

### Recovery

The last reading is adopted or a fixed value of 80 °C if intake air temperature exceeds a certain value

Mixture concentration self-adaption is inhibited.
The radiator fan is activated.
Idle self-adaption is inhibited.

### Checking resistance

The table alongside shows sensor resistance values at different temperatures. These may be measured by disconnecting the connector and connecting an ohmmeter to the sensor terminals.

### Removing-refitting

Disconnect electrical connection and remove the sensor.

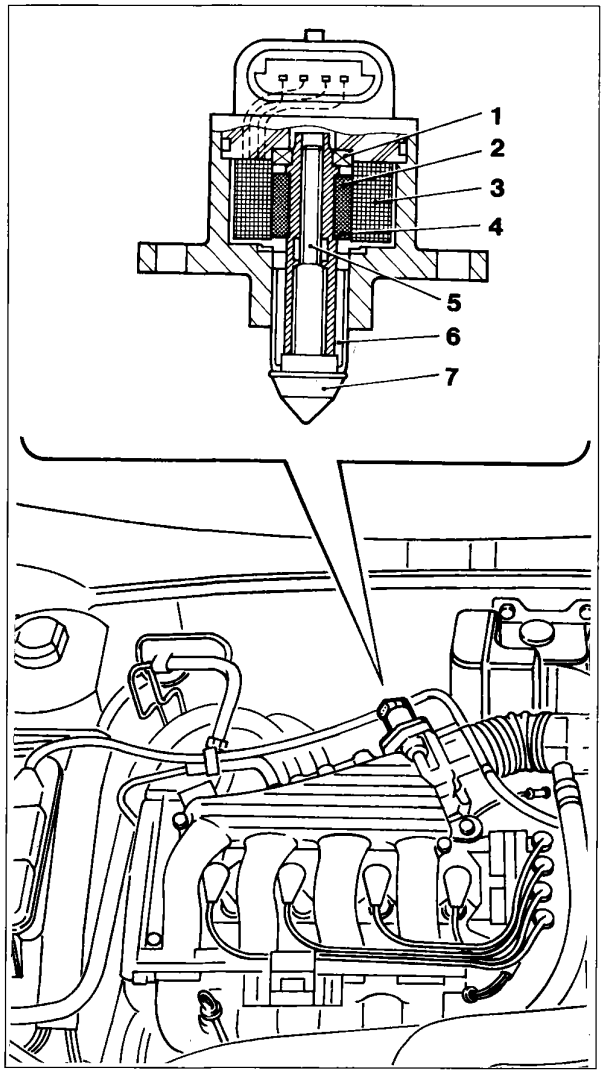
**Tightening torque 2.2 daNm.**

### Wiring connector

The numbers in boxes indicate the corresponding control unit pins.



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P4F36IJ01

## ENGINE IDLE SPEED ACTUATOR (step motor) (IB02)

1. Bearing
2. Lead screw
3. Coils
4. Magnets
5. Screw
6. Anti-rotation grooves
7. Plunger

The actuator is fitted to the throttle body and consists of:

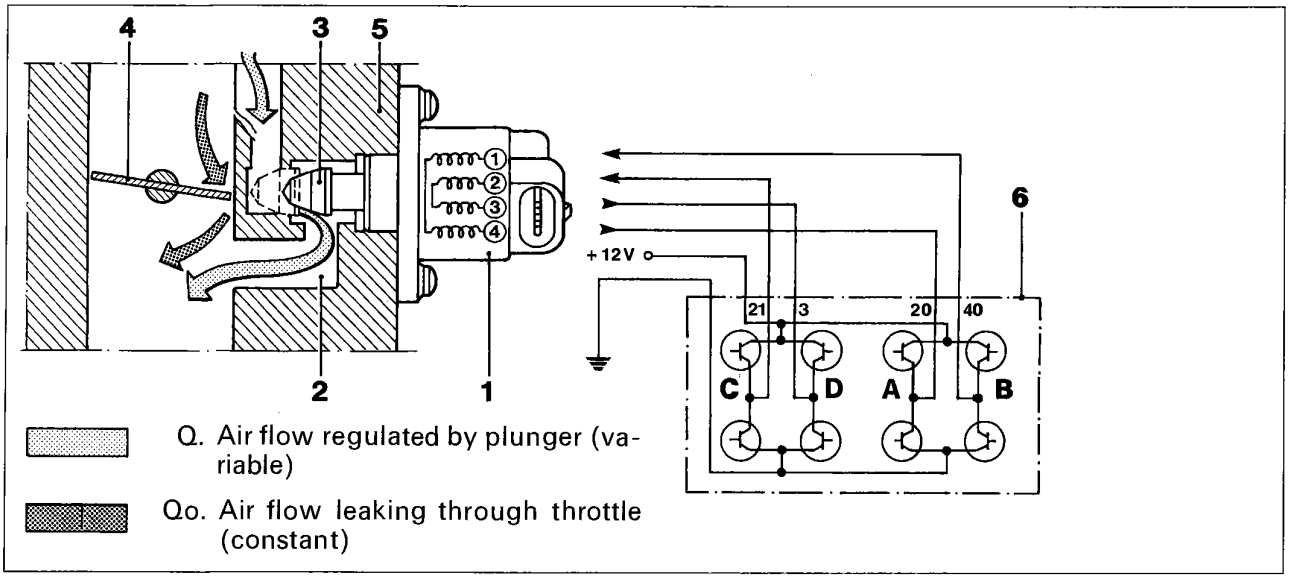
- An electric step motor with two windings in the stator and a rotor that contains a certain number of permanent magnet pairs.
- A worm and screw reduction unit that converts rotatory motion into linear motion.

In order to idle, i.e. with throttle (4) fully closed, the engine needs a certain amount of air (Qo) and fuel to overcome internal friction and maintain rpm levels.

To the quantity of air Qo that leaks through the closed throttle valve (4) during idling, an additional quantity of air Q must be added to allow the engine to maintain rpm levels constant, particularly during warm up and when electrical users or external loads are activated (air conditioner, automatic transmission, etc).

To achieve this result, the system uses a step motor (1) fastened to butterfly valve case (5) controlled by ECU (6) which moves a rod fitted with a plunger (3) during operation. This alters the cross-section of by-pass duct (2) and thus the amount of air (Qo + Q) taken in by the engine.

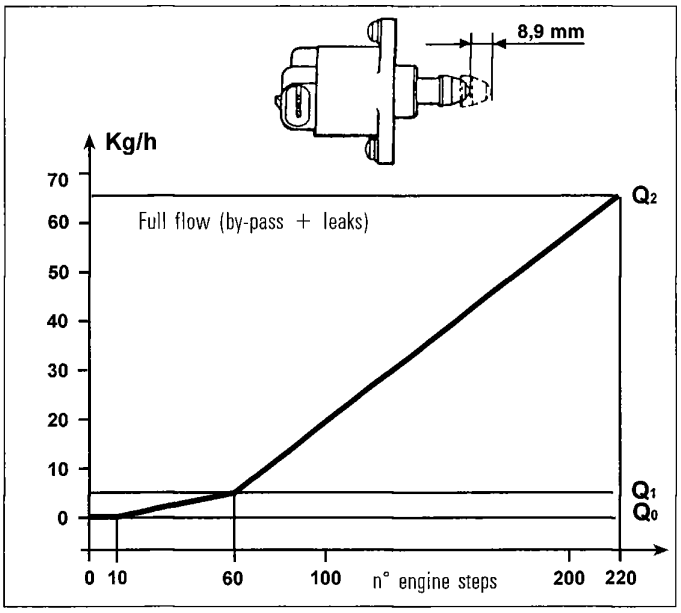
In order to govern this type of action, the ECU uses angular engine speed and coolant temperature input from the relevant sensors.




P4F36IJ02



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The electric step motor features extremely high accuracy and resolution (about 220 steps per second). Pulses sent from the ECU to the engine are converted from rotary motion into straight-line motion (about 0.04 mm/step) through a worm and screw mechanism. This operates a plunger which in turn moves to alter the by-pass duct cross-section.

The constant idle air flow Qo arises as a result of leakage through the butterfly valve. This is regulated during production and protected by a cap. Maximum flow Q2 arises when the plunger is fully retracted (about 200 steps corresponding to 8.9 mm). Between these two levels, air flow follows the graph shown alongside.

## Motor strategy

The number of working steps is dependent upon engine conditions:

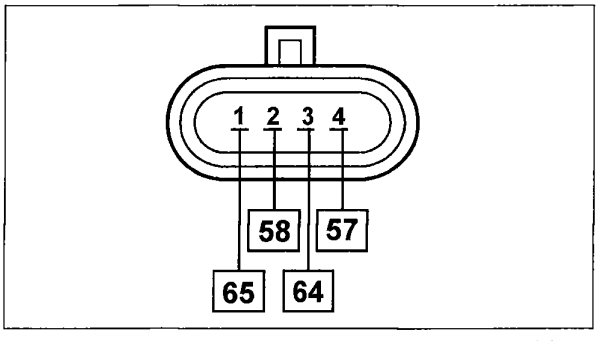
- Start-up stage
  When the key is inserted, the ECU controls step motor position according to engine coolant temperature and battery voltage.
- Warming-up stage
  Rpm levels are corrected according to engine coolant temperature.
- With engine warm:
  Idle control is dependent on a signal from the rpm sensor. When external users are activated, the ECU governs sustained idle.
- Over-run:
  The ECU recognises over-run status from the throttle potentiometer position.
  It controls step motor position by means of the idle flow law (DASH-POT laws). In other words, it slows the return of pluger (3) to its seat so that a quantity of air by-passing hole (2) reaches the engine and reduces levels of pollutants in the exhaust gas.

## Recovery

Actuator operation disenabled, self-adaption of idling fuel mixture level blocked and speed limited to 1200 rpm.

## Removing-refitting engine idle control actuator (step motor)

- disconnect the battery negative terminal;
- unscrew both retaining screws and withdraw the actuator;
- check condition of thoroid seal and remove any impurities from the case seat;
- refit the actuator, checking that the plunger fits easily without forcing.



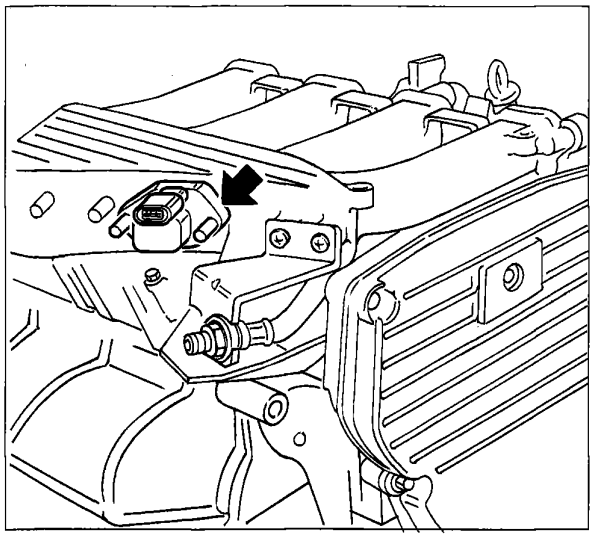

**Tightening torque of step motor screws 0.35 - 0.45 da Nm.**

### Wiring connector

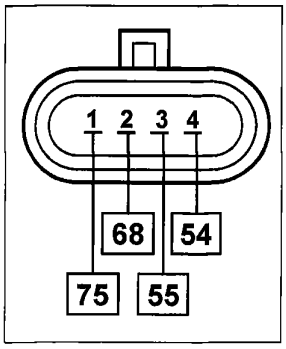
The numbers in boxes indicate the corresponding control unit pins



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P4F38IJ02

Pin 1-Air pressure signal

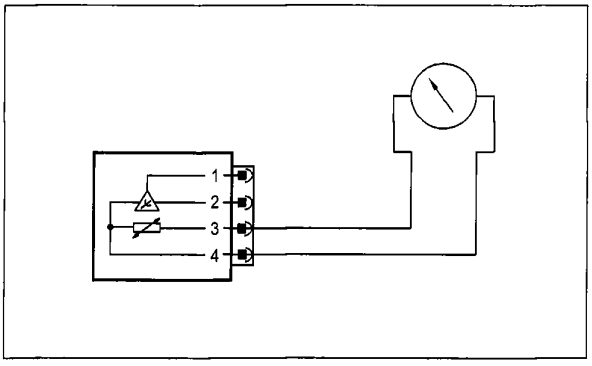
Pin 2-Positive

Pin 3-Air temperature signal

Pin 4-Negative

**Wiring connector**

The numbers in boxes indicate the corresponding control unit pins.




P4F38IJ03

**Checking resistance**

The table alongside shows resistance values that the temperature sensor (NTC thermistor) may assume at different temperatures. These values may be measured by connecting an ohmmeter to the terminals of sensor pins 3 and 4.

## INTAKE AIR PRESSURE AND TEMPERATURE SENSOR (T-PRT 03)

The intake air pressure and temperature sensor is an integral component. It measures air pressure and temperature inside the intake manifold. The injection control unit needs both items of information to establish the amount of air taken up by the engine. This information is then used to compute injection time and ignition point. The sensor is fitted to the intake manifold.

### Automatic diagnosis and recovery

The self-diagnostic function monitors the two sensor output signals.

This detects the following for both signals:

- Short-circuit to earth.
- Short circuit to positive and reference voltage.
- Circuit open / interrupted

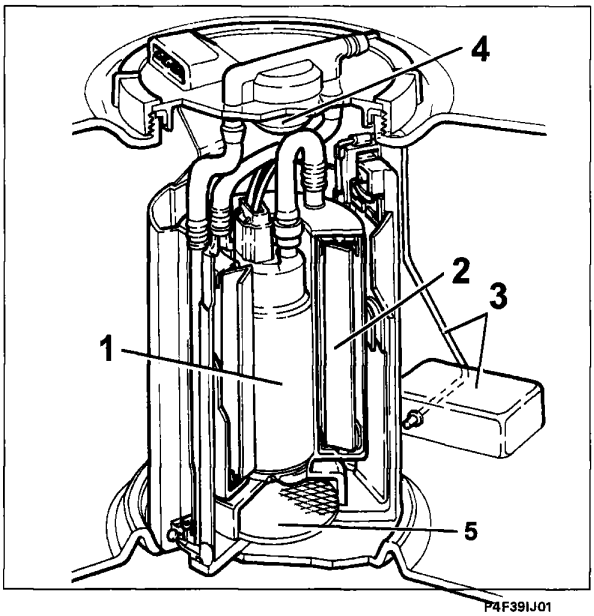
When the sensor pressure signal required to calculate injection time and ignition point is not present, the throttle potentiometer signal and engine rpm signal are used instead. These are processed by the electronic control unit to reconstruct the missing signal. If the air temperature sensor breaks, the injection control unit uses the last reading as the recovery temperature. If the fault occurs upon start-up, it assumes a fixed value of 45 °C and mixture self-adaption is disabled.

If the pressure sensor fails, a fixed value of 1024 mBar is used.

| Temperature (°C) | Resistance (Ω) |
|---|---|
| -40 | 49933 ± 13.6% |
| -20 | 15701 ± 10.8% |
| 0 | 5959 ± 8.5% |
| 10 | 3820 ± 7.4% |
| 20 | 2509 ± 6.5% |
| 25 | 2051 ± 6.0% |
| 30 | 1686 ± 6.0% |
| 40 | 1157 ± 5.9% |
| 50 | 810 ± 5.8% |
| 60 | 578 ± 5.7% |
| 80 | 309 ± 5.5% |
| 100 | 176 ± 5.4% |



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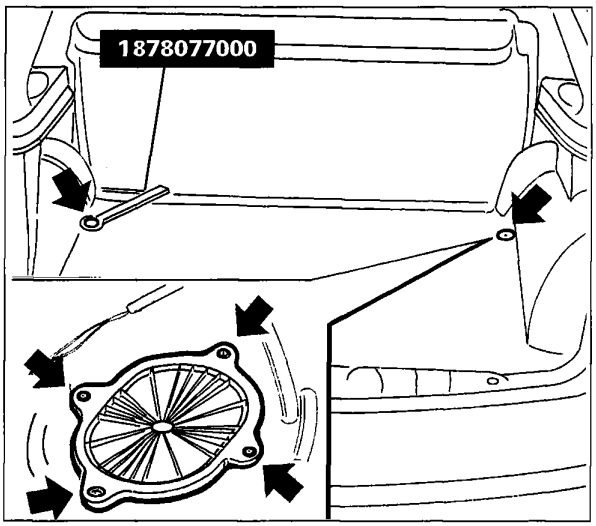


P4F39IJ01

## ELECTRIC FUEL PUMP (ESS 291)

The pump assembly consists mainly of:
- an electric fuel pump (1);
- a fuel filter (2);
- a float-type level gauge (3);
- a membrane-type pressure regulator (4);
- a mesh prefilter (5).

The electric pump is single-stage peripheral flow type wit high performance under low voltage and temperature conditions. It offers the following advantages over electric pumps which work on the volumetric principle: low weight and reduced size.



P4F39IJ02

### Removing-refitting electric fuel pump

The pump is located in the tank. Proceed as follows to remove:

Undo the fastening studs indicated using tool 1878077000.

Lift the luggage compartment mat.

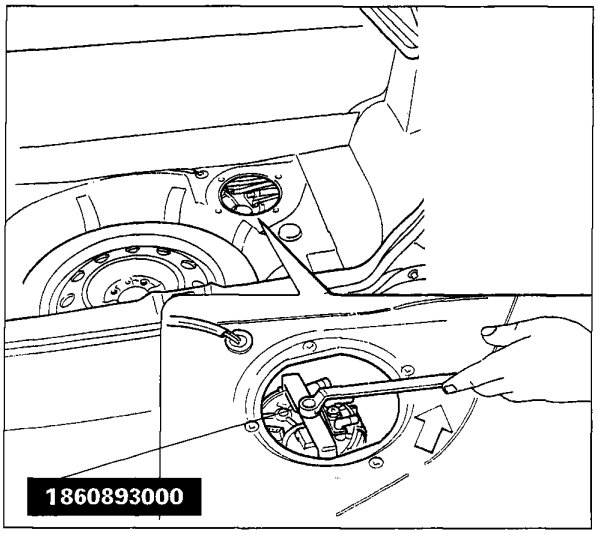
Unscrew the bolts indicated and remove the dust cover.

Disconnect electrical connection to the pump and fuel level sender unit.

Disconnect the fuel delivery line.

Unscrew the lock-ring retaining the electric pump to the tank using tool 1860893000 and one box wrench.

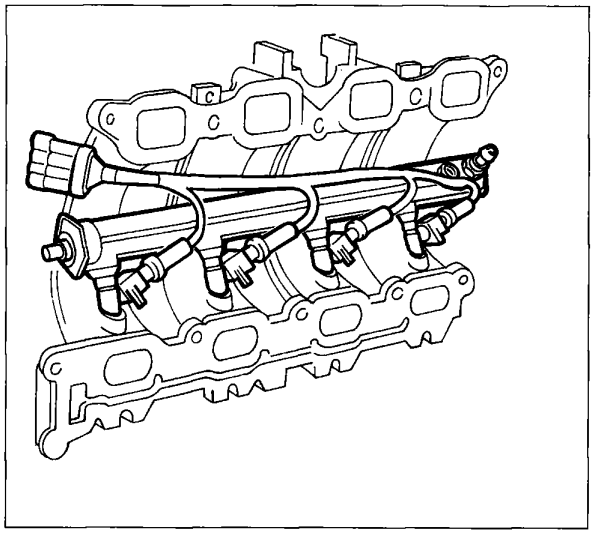
Disconnect fuel pump assembly.



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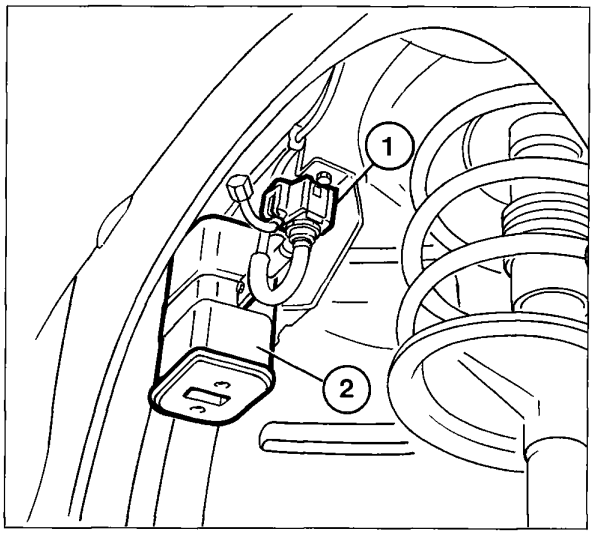
P4F40IJ01

## FUEL MANIFOLD (CB 168)

The fuel manifold is fastened to the inner part of the intake manifold. Its function is to direct fuel to the injectors.

The fuel manifold is pressure cast in aluminium and incorporates injector seats.

The fuel intake is fastened using bolts with tapered seals.



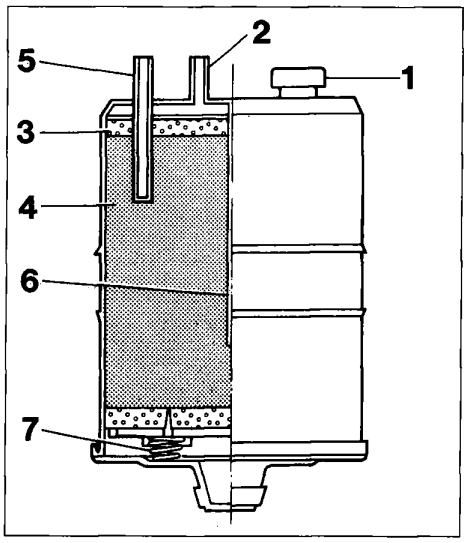

P4F40IJ02

## CARBON FILTER AND FUEL VAPOUR CUT-OFF VALVE

These components form part of the fuel evaporation control and vapour recovery system. They are located in the right wheel arch compartment and can be reached by removing the rear part of the right front wheel arch compartment trim.

1. Fuel vapour cut-off solenoid

2. Carbon filter




P4F40IJ03

### Carbon filter

This consists of carbon granules (4) that trap fuel vapour entering intake (5).

Warm flushing air enters intake (1), through paper filter (3) and flows over the carbon granules to remove fuel vapours and carry them toward the outlet (2) and then on toward the cut-off valve.

Air entering through intake (5) may also be pulled back by a vacuum in the tank, when it serves to ventilate the tank. Partition (6) ensures that the flushing air flows over all the carbon granules and promotes the release of fuel vapour toward the inlet manifold.

Two springs (7) allow the mass of granules to expand when the pressure increases.



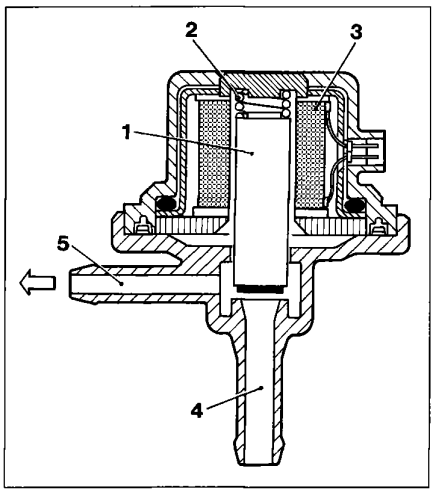
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### Fuel vapour cut-off solenoid (EC1)

The function of this valve is to control the quantity of fuel taken up by the active carbon filter and directed to the intake manifold (via the injection-ignition control unit).
The valve is closed when de-activated to prevent fuel vapours enriching the mixture excessively.
The injection-ignition control unit controls operation as follows:

- during start-up, the solenoid remains closed to prevent fuel vapour from enriching the mixture excessively. This condition persists until the coolant temperature reaches a pre-established threshold (about 60°C).
- with engine warm, the ECU sends the solenoid a square wave signal, which modulates opening in accordance with the signal empty/full pattern.

  In this way, the ECU controls the quantity of fuel vapour sent to the intake to prevent significant changes in mixture concentration.



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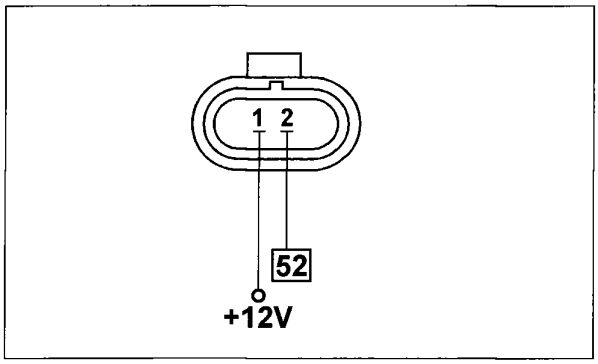
Under the service conditions listed below:

- throttle in idle position
- speed less than 1500 rpm
- intake manifold pressure less than a limit setting computed by the ECU according to rpm level

solenoid activation is inhibited to maintain the unit closed in order to improve engine operation.

**Longitudinal section through fuel vapour cut-off valve**

1. Valve core.
2. Reaction spring.
3. Magnetic winding.
4. Pipe connected to air intake manifold
5. Pipe connected to active carbon filter.



P4F41IJ02

**Wiring connector**

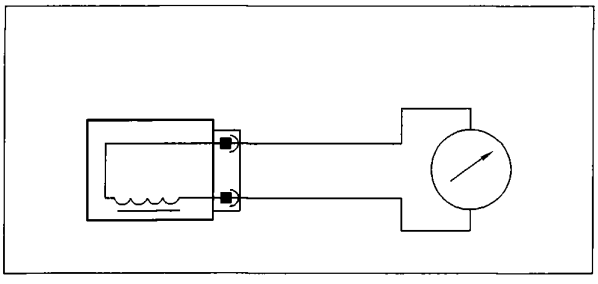
The numbers in boxes indicate the corresponding control unit pins

**Recovery**

Solenoid control is inhibited

Fuel vapour recirculation self-adaption is inhibited.

Mixture self-adaption is inhibited.


P4F41IJ03

**Checking resistance**

Solenoid resistance may be measured by disconnecting the connector and connecting an ohmmeter as shown in the figure.

**Resistance: 17.5 - 23.5 ohm at 20 °C**



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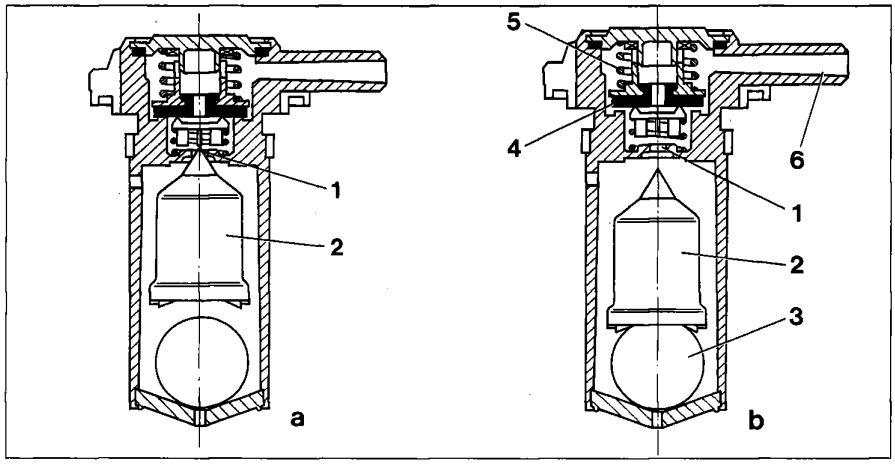
# 10.

## MULTIFUNCTION VALVE (SIRIO 0175.00)

This valve performs the following functions:
- prevents fuel flowing out when tank is over-filled or in case the vehicle overturns in an accident;
- vents fuel vapours from tank to the active carbon trap filter;
- ventilates the tank if a vacuum builds up inside.

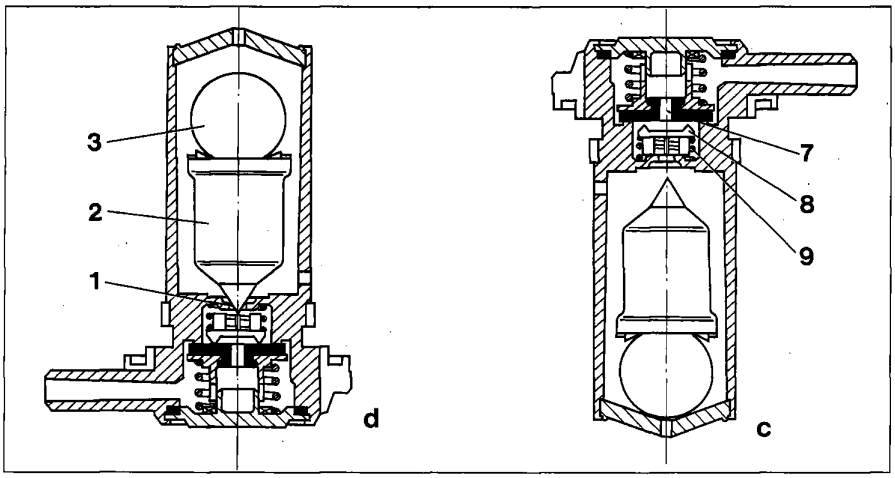
This valve consists of: a float (2); a heavy ball (3); a plate (4), pushed against valve case of spring (5) and plate (8), pushed against plate (4) of spring (9). Multifunctional valve operation may be summarised as follows and depends on fuel tank level:

a. if the tank is full float (2) blocks hole (1) to prevent liquid fuel from reaching active carbon filter and hence damage to the filter;
b. the tank fuel level drops, float (2) is lowered and rests upon ball (3) to open hole (1). When the pressure exercised by fuel vapours on plate (4) overcomes load of spring (5), a ring opening between plate and valve case opens to allow fuel vapours to emerge from the duct (6) and reach the active carbon filter.




P4F42IJ01 P4F42IJ02

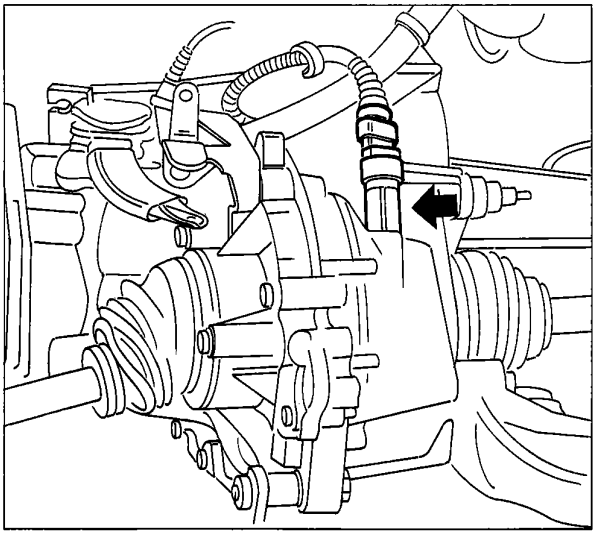
c. if the drop in tank fuel level is sufficient to set up a vacuum, this acts on plate (8) and overcomes load of spring (9) so that this moves down to allow tank ventilation through hole (7).
d. if the vehicle overturns, however full the tank, the weight of ball (3) acts on float (2) to push the float against hole (1) and prevent a dangerous flow of fuel to the intake manifold with the attendant risk of the vehicle catching fire.




P4F42IJ03 P4F42IJ04



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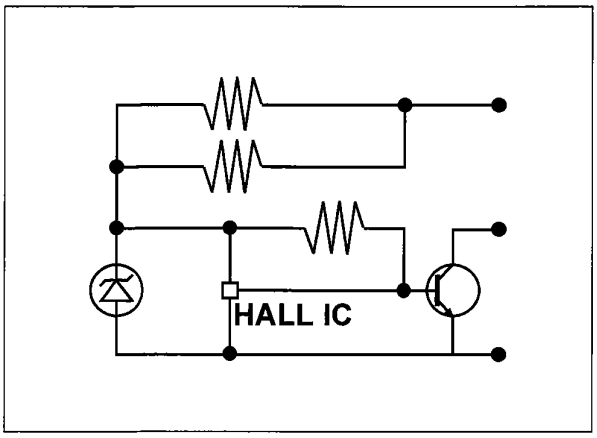


P4F43IJ01

## VEHICLE SPEED SENSOR (SOGECO)

The sensor is located on the differential output, near the left half-axle joint. It sends information on vehicle speed to the control unit: the signal is also used to operate the speedometer.

The sensor operates on the principle of the Hall effect (see section on "engine timing sensor") and transmits 16 pulses/revolution. Vehicle speed can therefore be calculated from pulse frequency.



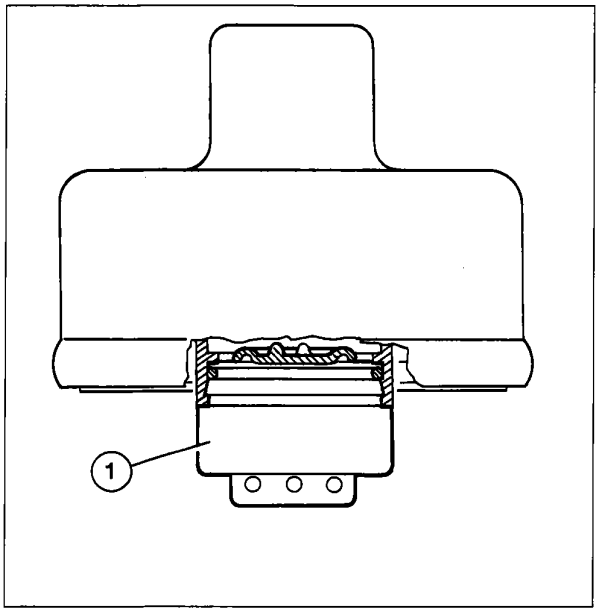

P4F43IJ02

### Removing - refitting

Disconnect electrical connection and remove the sensor.

**Tightening torque 0.8 daNm**

### Wiring diagram




P4F43IJ03

## SAFETY AND VENTILATION VALVE

This valve is located in the fuel filler cap and performs the following functions according to the pressure level in the tank:

- When the pressure inside the tank exceeds 0.13 - 0.18 bar, excess fuel vapours are vented to the outside (pressure-relief function).
- If, on the other hand, a vacuum builds up inside the tank, equivalent to 0.020 - 0.030 bar, air is taken into the tank (ventilation function).



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# 10.

## INJECTORS (IWP 064)

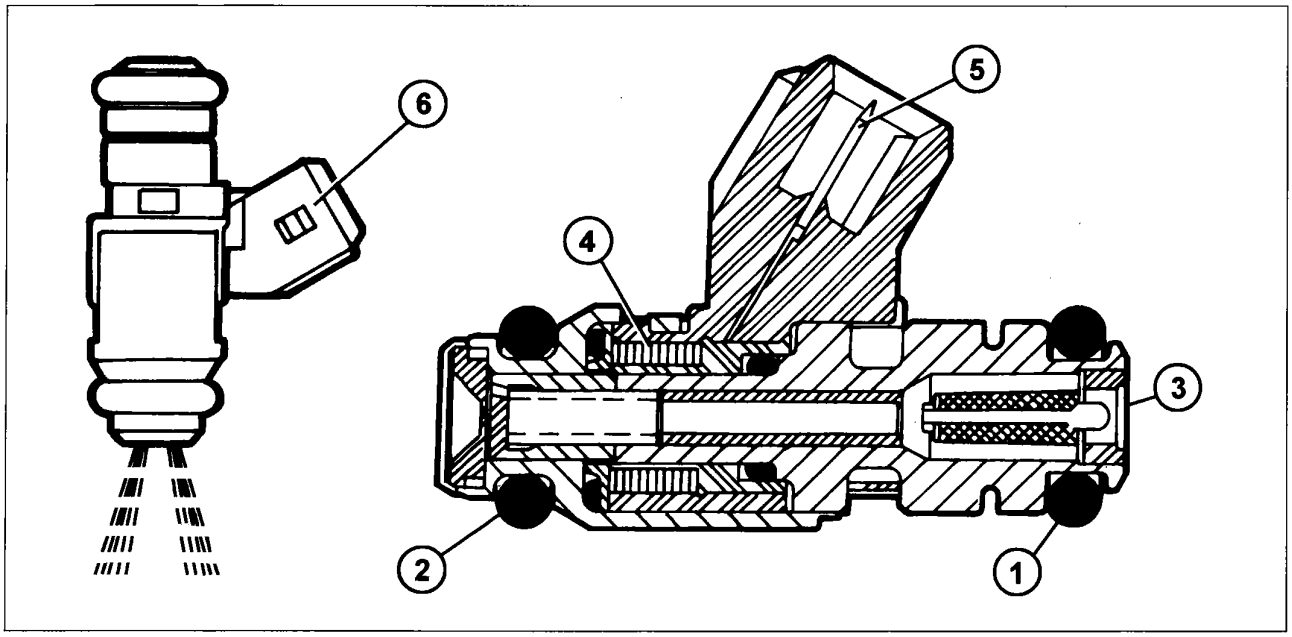
The twin-jet top-feed injectors (spray is inclined in relation to the injector centre-line) are specific for four valve per cylinder engines. They allow the jets to be directed toward the two intake valves.
Fuel jets at a differential pressure of 3 bars leave the injector and are immediately nebulised to form two propogation cones.

The injector control system is «timed, sequential» type, i.e. the four injectors are controlled in accordance with the engine cylinder intake sequence. Fuel delivery for each cylinder may begin during the expansion stage and last through to the a point when the intake stage has already begun.

The injectors are held in place by the fuel manifold, which presses them into their seats on the intake ducts. They are also anchored to the fuel manifold by safety clips. Two viton rings (1) and (2) form a seal on the intake duct and fuel manifold.

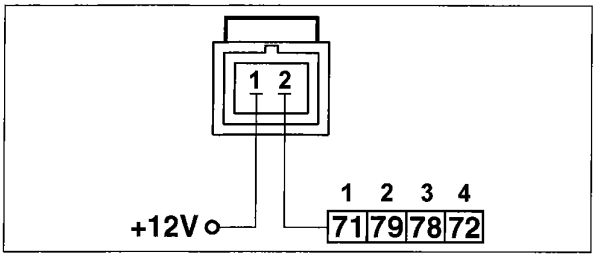
Fuel is supplied from the top part (3) of the injector. Th case contains winding (4) connected to terminals (5) of electrical connector (6).

**NOTE** *When removing-refitting, do not apply stresses higher than 120 N to injection connector (6) or it may be damaged..*




P4F44IJ01

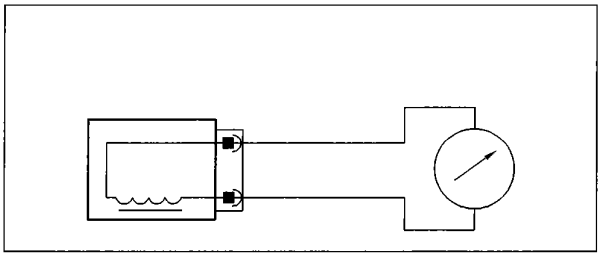
### Wiring connector




P4F44IJ02

**NOTE** *The numbers in boxes indicate ECU pin no. in order of cylinder number.*

### Checking resistance



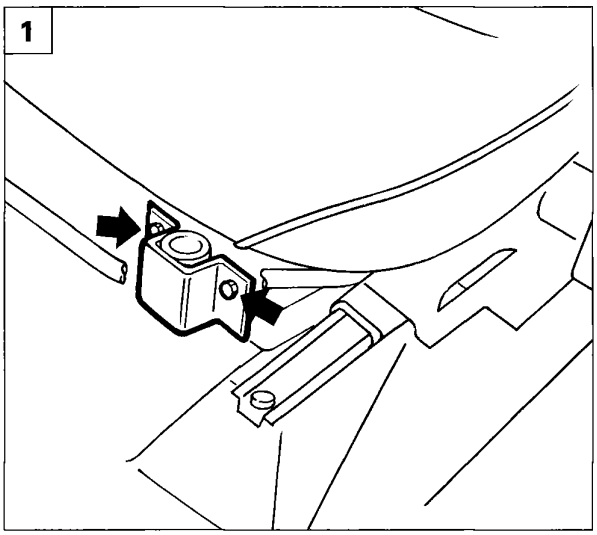
P4F41IJ03

The injector resistance may be measured by disconnecting connector and connecting an ohmmeter as shown in the figure.

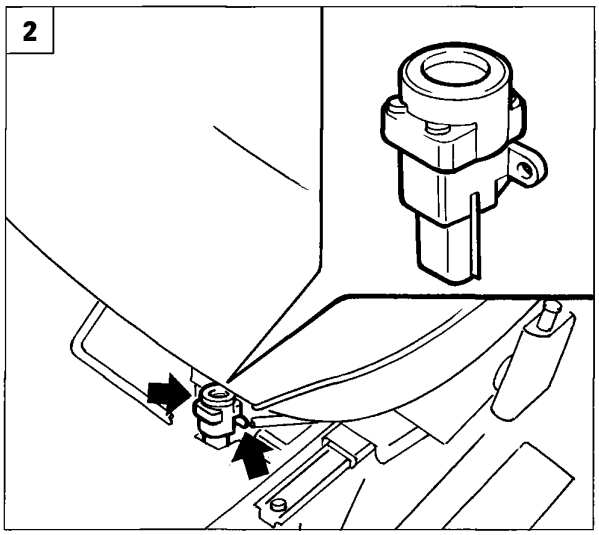
**Resistance: 13.7 - 15.2 ohm at 20 °C**



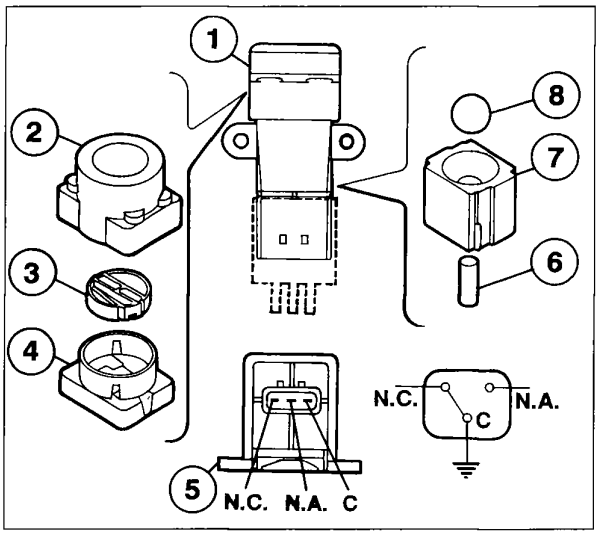
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P4F45IJ01




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P4F45IJ03

## INERTIA SAFETY SWITCH

The vehicle is equipped with an inertia switch located inside the passenger compartment beneath the driver's seat to increase passenger safety in the case of impact.
This sensor reduces the possibility of fire (caused by fuel emerging from the injection system) by de-activating the fuel feed pump.
The switch consists of a steel ball fitted inside a tapered housing. It is held in position through the attractive force of an permanent magnet.
The ball is released from the magnetic force in the case of violent impact, when it opens the normally closed (NC) electrical circuit to cut off the fuel pump earth connection and thus the fuel supply to the injection system.
To restore the pump earth connection, push the seat back and press the switch until it clicks on.

### Removing-refitting

1. Move driver's seat back fully, unscrew the bolts indicated and remove the plastic protection.
2. Unscrew the bolts, disconnect electrical connection and remove the switch.

*After even an apparently slight collision, if a smell of petrol is noted or fuel leaks are seen, do not activate the switch again until the fault has been found and corrected in order to avoid the risk of fire.*

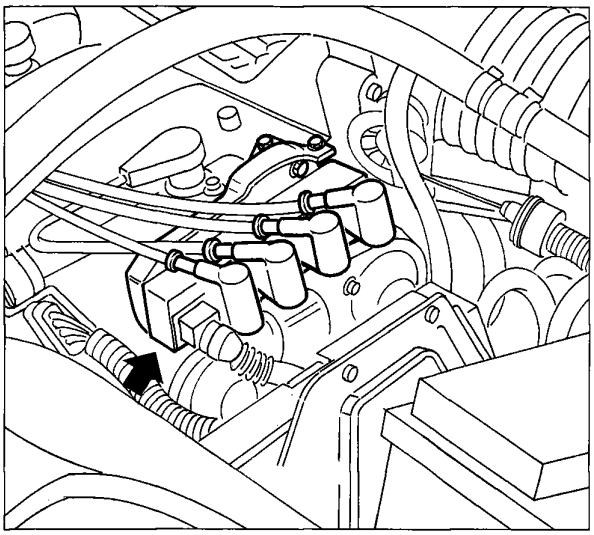
### Components of inertia switch

1. Inertia switch assembly
2. Sheath
3. Button
4. Upper end
5. Fitting end
6. Permanent magnet
7. Permanent magnet seat
8. Steel ball

C= Common terminal
N.C. Normally closed
N.A. Normally open



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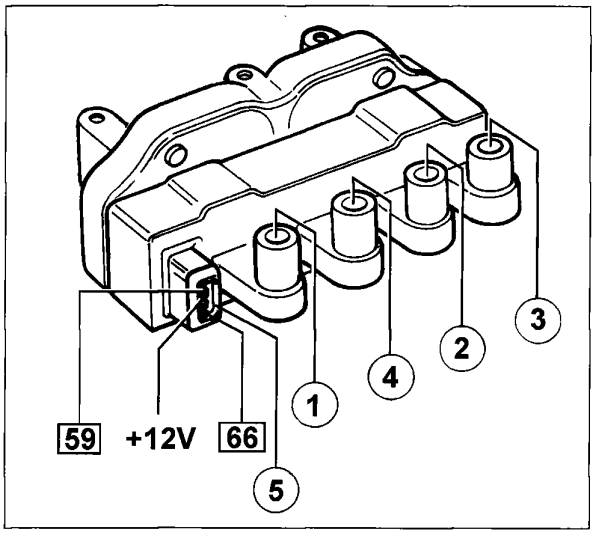


P4F46IJ01

## IGNITION COILS
**(Bae 920A)**
**(Beru 0.040.100.029)**

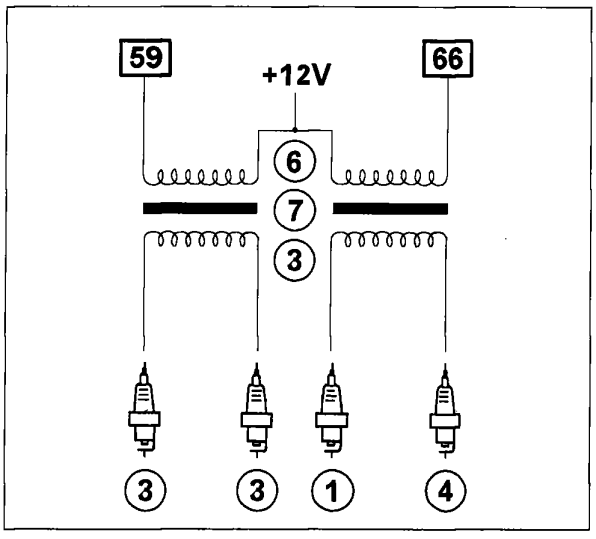
The coils are fastened by means of a bracket to the camshaft covers and are closed magnetic loop type. They are formed from a layered pack, whose central core (broken by a narrow gap) carries both windings.

The windings are placed in a moulded plastic container embedded in epoxy resin, which gives them exceptional dielectric properties. Because the primary winding is so close to the magnetic core, little magnetic flux is lost and coupling with the secondary winding is maximised.




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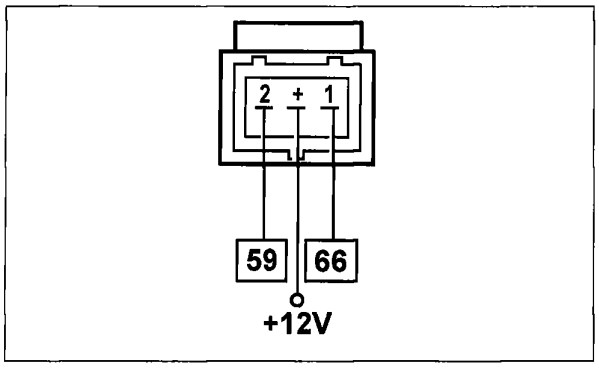
1. HT socket for cylinder no. 1 spark plug
2. HT socket for cylinder no. 2 spark plug
3. HT socket for cylinder no. 3 spark plug
4. HT socket for cylinder no. 4 spark plug
5. LT socket for ECU connection
6. Primary circuit
7. Gap
8. Secondary circuit




P4F46IJ03

### Wiring connector

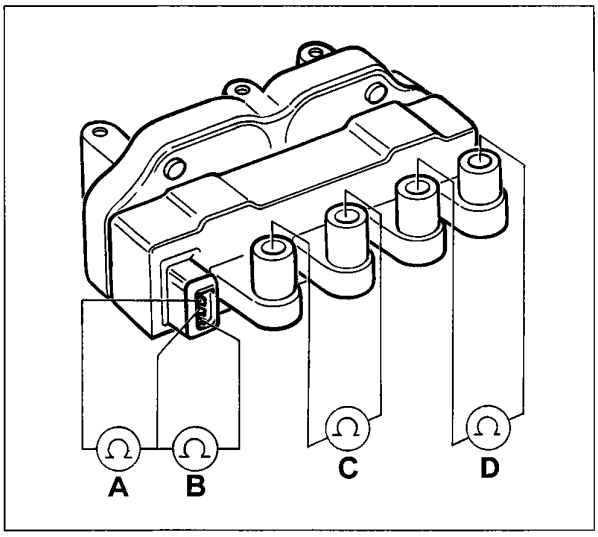
**NOTE** *The numbers in boxes indicate the corresponding control unit pins.*




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P4F47IJ01

### Checking winding resistance

**Primary circuit (A cylinders 1-4, B cylinders 2-3)**

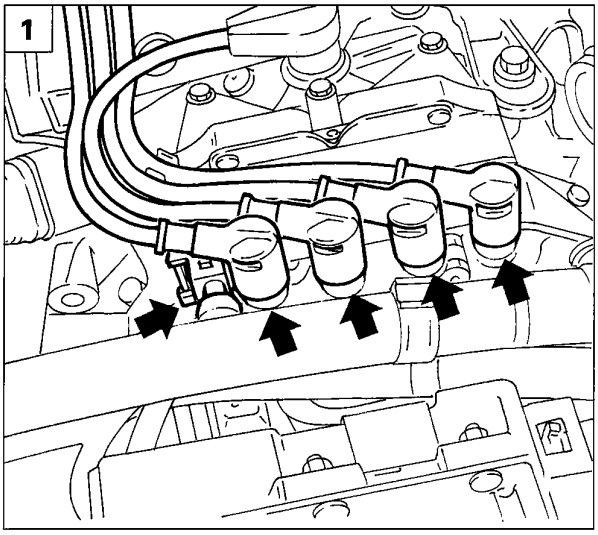
Bring the probes of an ohmmeter into contact with the postive strip (central pin) and the negative strip (pin 1 for circuit A and pin 2 for circuit B).

The primary circuit resistance reading on the guage should be between 0.44 and 0.53 ohm at 23 °C.

**Secondary circuit (C cylinders 1-4, D cylinders 2-3)**

Bring the probes of an ohmmeter into contact between the two high tension outlet terminals.

The secondary winding resistance reading on the gauge must be between 4500 and 5500 ohm at 23 °C.




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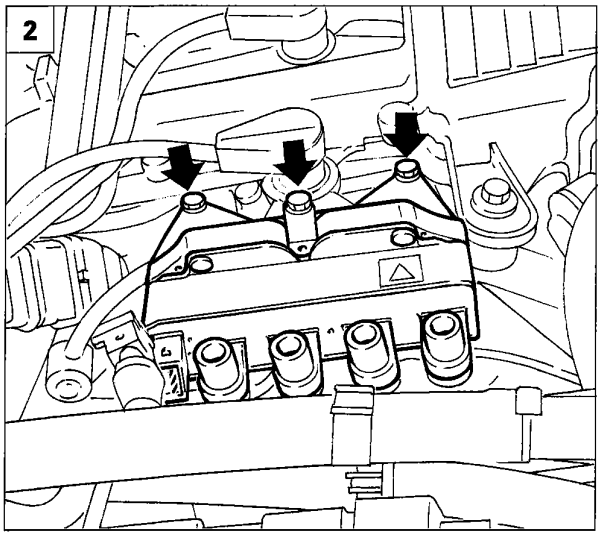
### Recovery

Inhibition of injectors for cylinders in which ingnition is not taking place.

Open-loop mixture control

Current command is de-activated in case of short circuit to positive in order to try again later.

If circuit is broken, or short-circuit to earth, charge time is assumed to be dependent upon battery voltage.




P4F47IJ03

### Removing refitting

1. Disconnect HT leads from spark plugs.

2. Unscrew the bolts indicated and remove the ignition coils



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# 10.

## LAMBDA PROBE (NTK 0ZA334-A1)

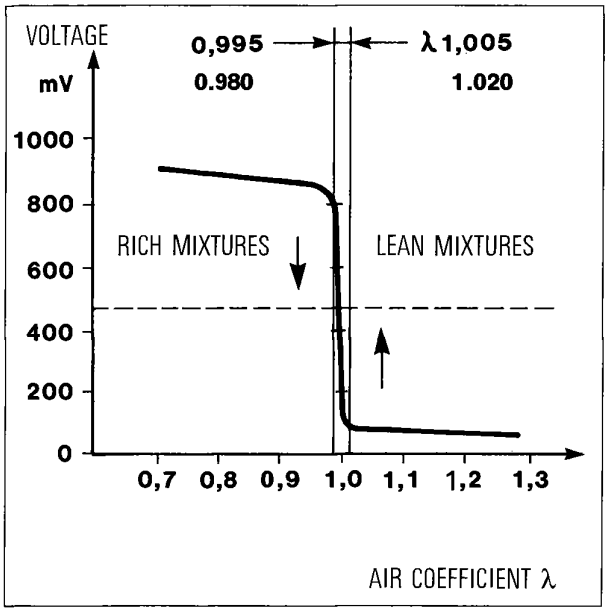
This sensor measures exhaust gas oxygen content.

The sensor output signal is sent to the electronic control unit to adjust the air-fuel mixture in order to maintain the ratio as close as possible to theoretical levels.

To obtain an optimum mixture, the quantity of fuel injected must be as close as possible to a theoretical quantity that could be fully burnt for a given amount of air taken in by the engine.

In this case, Lambda factor (λ) is said to be equal to 1;in fact:

$$\lambda = \frac{\text{INTAKE AIR QUANTITY}}{\text{THEORETICAL QUANTITY OF AIR NECESSARY TO BURN ALL THE FUEL INJECTED}}$$




λ= 1 Ideal mixture
CO levels are within legal limits

λ⩾ 1 Lean mixture
Excess air; CO levels tend to be low

λ⩽ 1 Rich mixture
Lack of air; CO levels tend to be high

**NOTE** *While the coefficient λ expresses an excess or lack of air supplied to the engine in relation to the theoretical required level, the air-fuel mixture is a ratio between these two substances that react chemically when combined. Present-day engines require 14.7-14.8 parts of air to burn 1 part of petrol fully.*

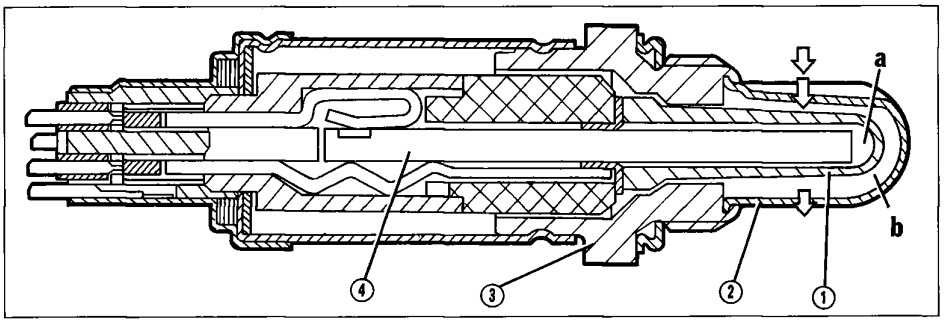
The probe is fastened upstream of the converter.

It consists of a ceramic case (1) made up of a zirconium dioxide base covered by a light layer of platinum. It is sealed at one end, enclosed in protective pipe (2), and housed in metal case (3) that provides further protection and permits installation to the exhaust manifold. The outer part (B) of the ceramic case is exposed to the exhaust gas flow while inner part (A) communicates with the outside air.

The probe works on the principle that when the temperature exceeds 300 °C, the ceramic material used begins to conduct oxygen ions. Under these conditions, if the levels of oxygen at both ends (a and b) of the probe are different, a voltage variation is set up between the two ends. This signal notifies the ECU that the oxygen residues in the exhaust gas are not in proportions that will ensure lean burning of harmful residues.



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a. (+) electrode in contact with outside air
b. (-) electrode in contact with exhaust gas
1. Ceramic case
2. Protective pipe
3. Metal case
4. Electrical resistant

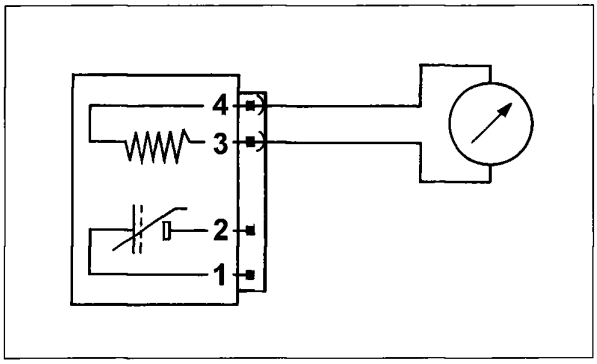
When the probe supplies a low voltage level (less than 200 mV) the ECU recognises that the mixture is lean (lambda » 1) and takes steps to increase the amount of fuel injected. When the probe supplies a high voltage level (greater than 800 mV) the control unti recognises that the mixture is rich (lambda « 1) and decreases the quantity of fuel injected.

The lambda probe therefore alters injection times to ensure that the engine operates with a lambda factor continually fluctuating between 0.980 and 1.020.

Below 300 °C the ceramic material is not active and the probe does not send usable signals. A special circuit in the control unit blocks loop mixture regulation while the probe is warming up.

To ensure service temperature is reached quickly, the probe is equipped with electrical resistance (**4**) supplied by the battery

*The probe may be swiftly put out of service by even slight traces of lead in the fuel.*

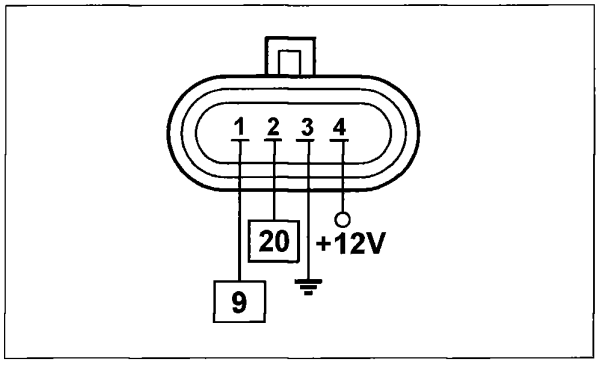



P4F49IJ02

### Checking resistance

The heater and probe resistance may be measured by disconnecting the connector and connecting an ohmmeter as indicated in the figure.

**Heater resistance = 4.3 - 4.7 ohm**




P4F49IJ03

### Recovery

Lambda data are ignored (open loop).

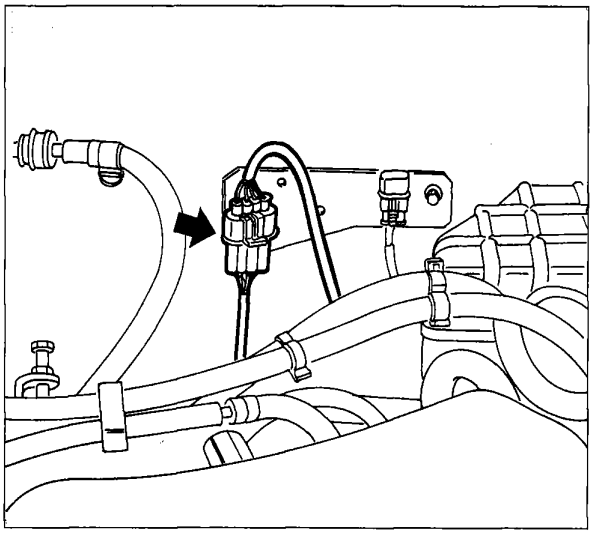
### Wiring connector

The numbers in boxes indicate corresponding control unit pins.



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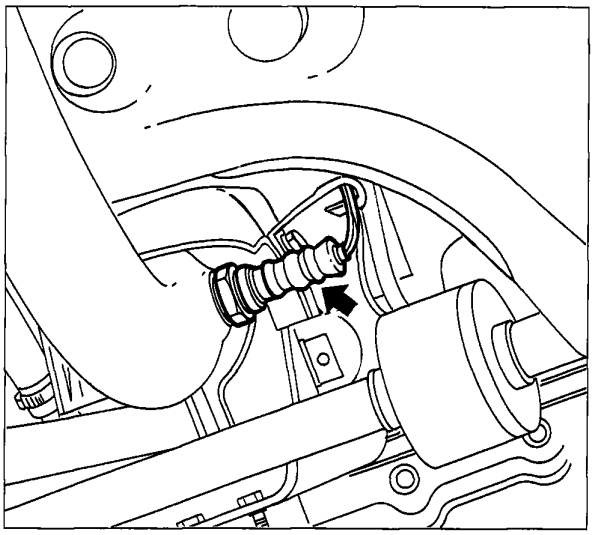
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**Removing - refitting lambda probe**

- Place the vehicle on a lift
- Disconnect battery negative lead
- Disconnect electrical connection located against the rear wall of the engine bay.



P4F50IJ02

Remove the lambda probe from its seat on the exhaust pipe.

*When refitting, spread the threaded part with 'ANTISEIZE MATERI-'A-BORON NITRIDE N.G.K. grease from SPARK PLUG CO-LTD.*

**Tightening torque 3.5 - 4.5 daNm**



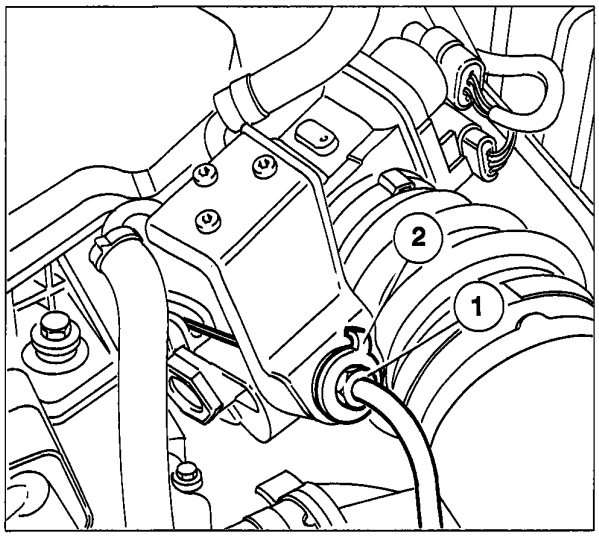
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## CHECKS, ADJUSTMENTS AND REPAIRS TO INJECTION-IGNITION SYSTEM

*OBSERVE THE FOLLOWING PRECAUTIONS WHEN WORKING ON VEHICLES WITH IAW INJECTION-IGNITION SYSTEMS:*

- *never start the engine when the electrical terminals are poorly connected or loose on the battery poles;*
- *never use a quick battery charger to start the engine;*
- *never disconnect the battery from the car circuit with the engine running;*
- *when charging the battery quickly, first disconnect the battery from the vehicle circuit;*
- *if the vehicle is placed in a drying oven after painting at a temperature of more than 80° C, first remove the injection/ignition ECU;*
- *never connect or disconnect the ECU multiple connector with the ignition key in MARCIA position;*
- *always disconnect battery negative lead before carrying out electrical welding on vehicle.*

*Note that the memory of this system is active at all times and contains all learnt self-adaptive parameters. Because all this information would be lost if the battery were disconnected, this operation should only be carried out when absolutely essential.*

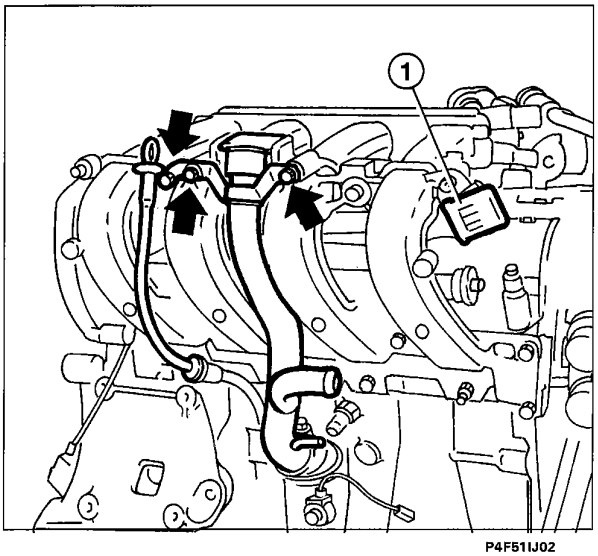


P4F51IJ01

### ADJUSTING THROTTLE CABLE

The accelerator cable is adjusted by loosening nut (1) and moving clip (2).

Position clip (2) so that the head of the accelerator cable enters the slot freely without altering idle speed. Then tighten nut (1) to lock.



P4F51IJ02

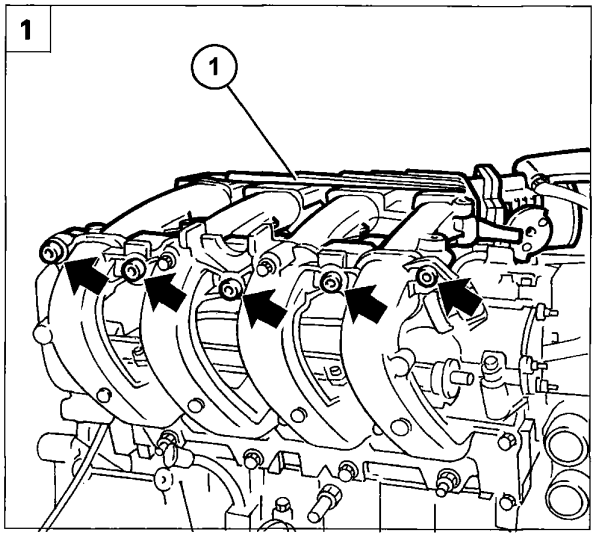
### REMOVING-REFITTING FUEL MANIFOLD AND INJECTORS

Disconnect the first section of the oil dipstick mount and the oil filler pipe, then disconnect the injector lead coupling (1).



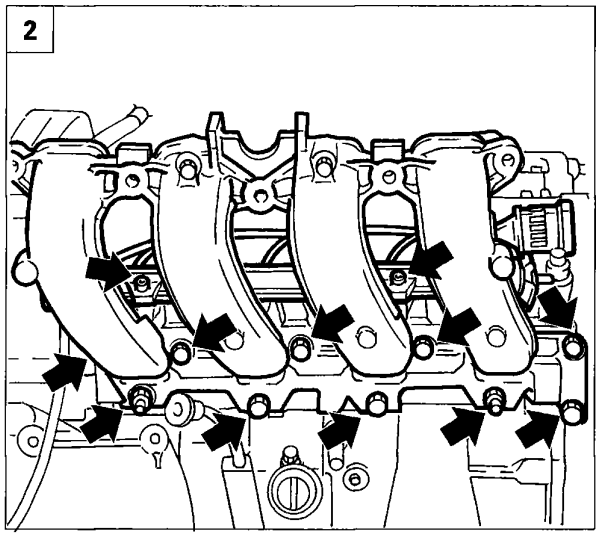
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1



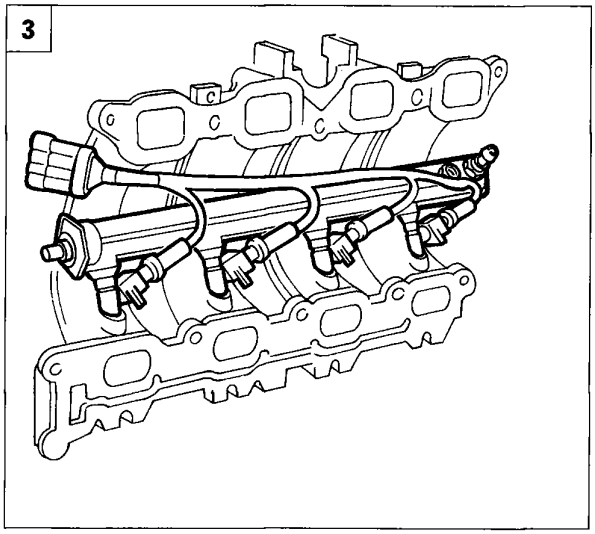

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2



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3

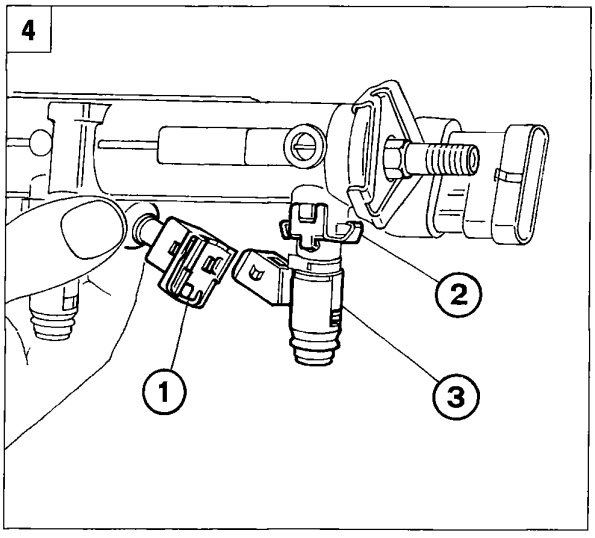


P4F40IJ01

1. Unscrew the bolts fastening both sections of the fuel supply manifold and remove the first section (1).
2. Unscrew the fuel manifold retaining bolts and the bolts fastening the second section of the intake manifold to the engine block and remove.
3. Disconnect the fuel lines and remove the manifold together with injectors.
4. Then remove the injectors as follows:

   - Disconnect electrical connection (1).
   - Remove the safety clip (2).
   - Remove press-fitted injector (3).

4



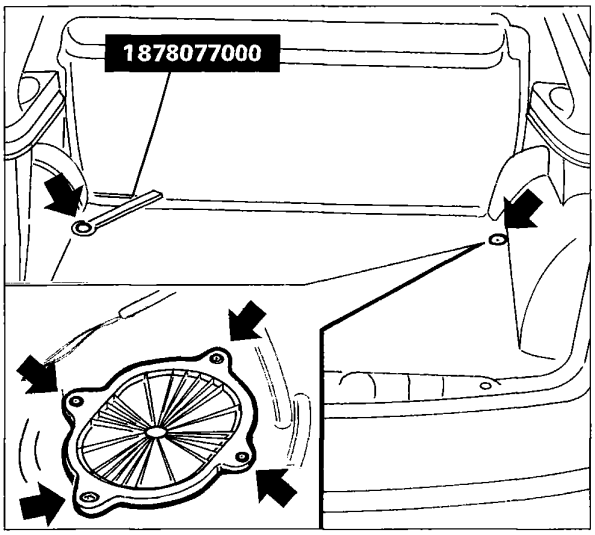

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Never pull the electrical connection to remove the injector.

Before refitting, check the seal is undamaged.



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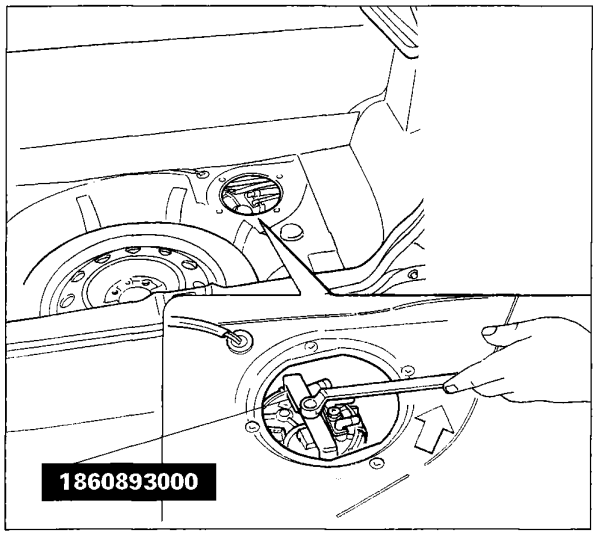



P4F39IJ02

## REMOVING-REFITTING FUEL TANK

Before proceeding with the removing-refitting of the tank, drain the fuel, position the vehicle on a lift and disconnect the negative battery lead. Then proceed as follows:

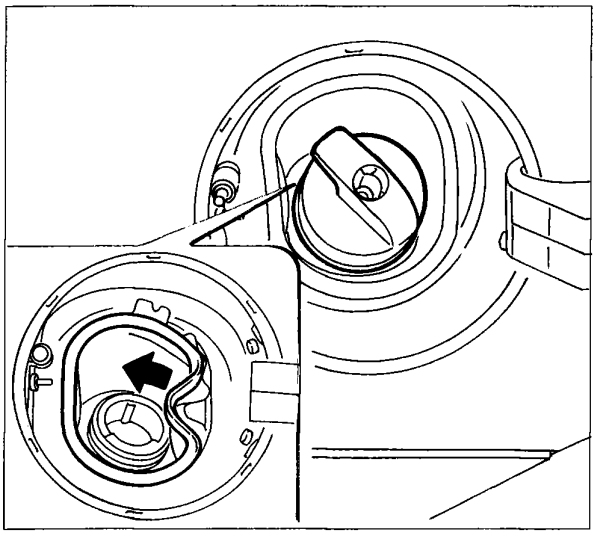
- Lift up the lining in the luggage compartment after having removed the retaining buttons using spanner 1878077000. Remove the protective cover shown in the inset, acting on the fixing bolts.




P4F39IJ03

- Disconnect the electrical connections from the pump and the fuel gauge sender unit. Disconnect the breather pipe (1) acting on the retaining nut and pipes (2) and (3), the fuel return and supply pipes, respectively, acting on the retaining tabs.

- Undo the ring nut fixing the electric pump to the tank using tool 1860893000 together with a polygonal spanner.



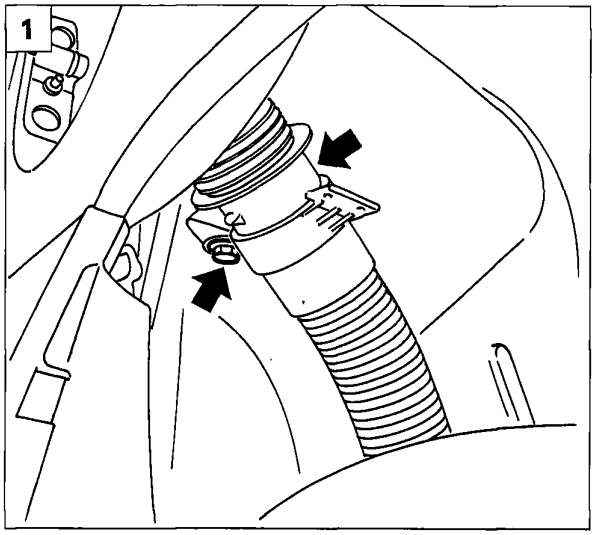
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- Undo the plug and remove the boot for the fuel filler from its housing.

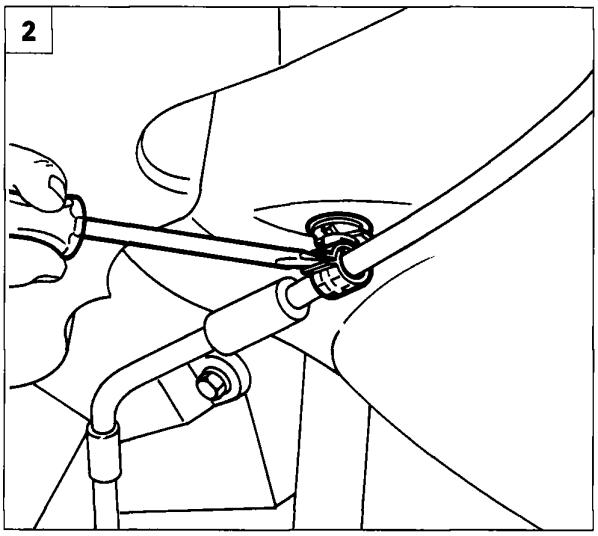


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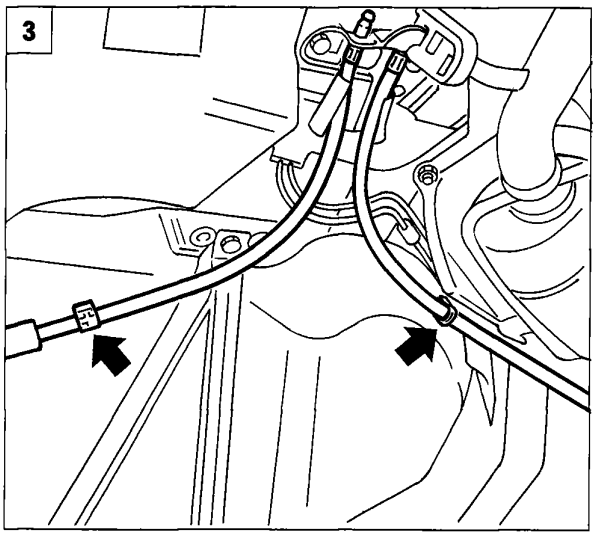
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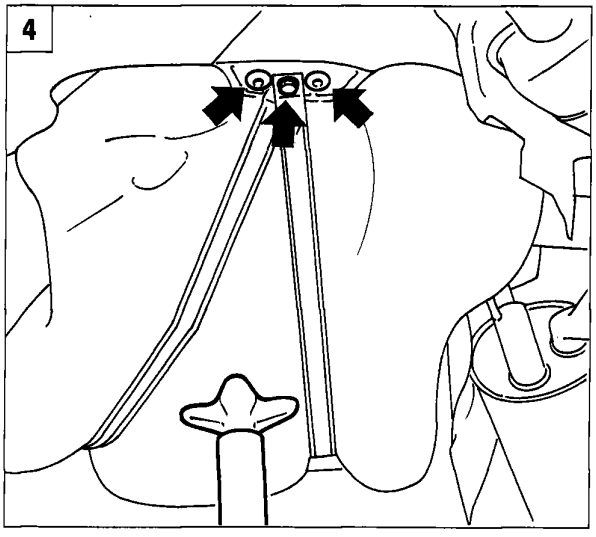

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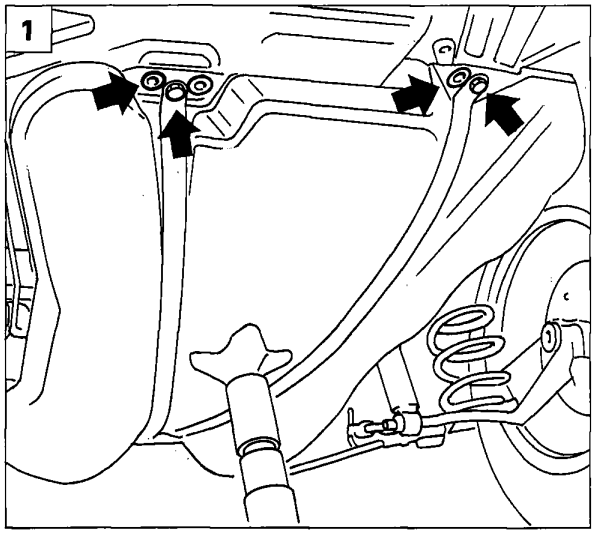
1. Remove the bolt shown and the plug retaining the fuel filler fitting to the body.

2-3. Open the collars arrowed and release the parking brake control cables from their anchorages on the fuel tank.

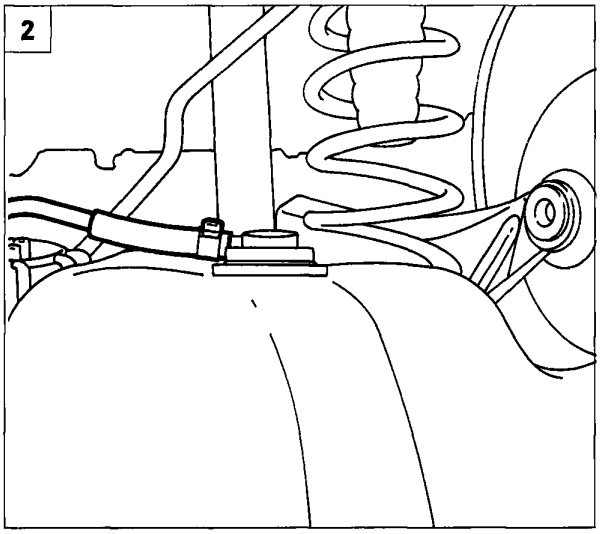
4. Arrange a hydraulic jack beneath the tank in order to support it during removing-refitting operations. Then remove the front bolt and plugs securing the tank to the body.



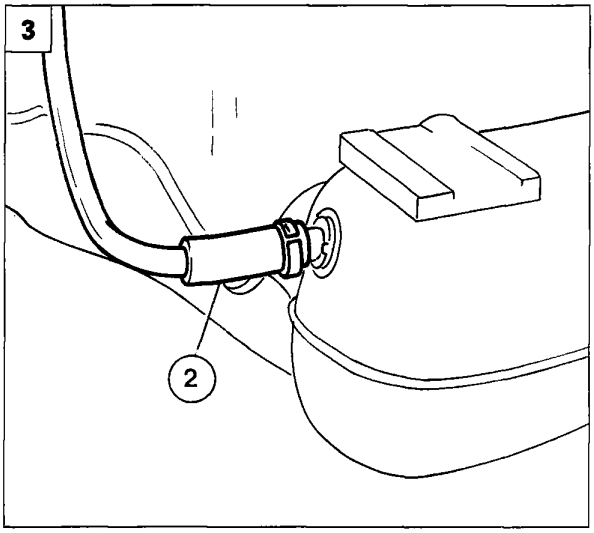
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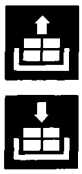

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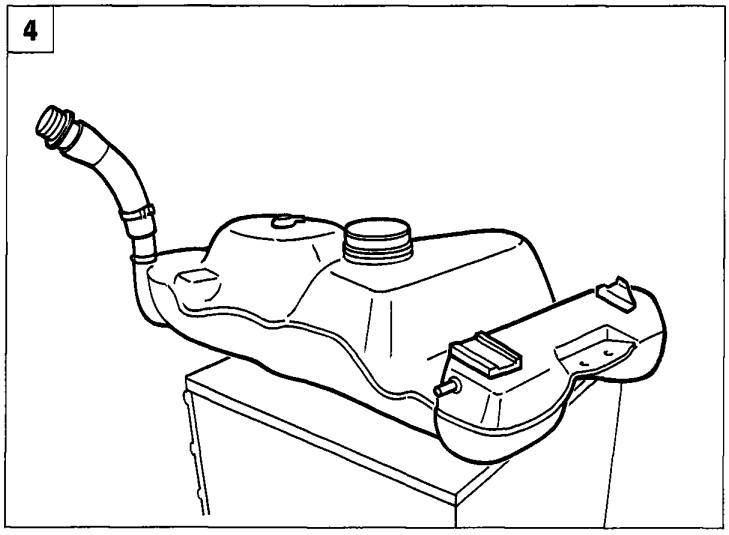

P4F55IJ03



1. Remove the rear bolts and plugs securing the tank to the body.

2. Gradually lower the hydraulic jack. Check that the tank is properly balanced, then disconnect the fuel vapour recovery pipe.

3. If necessary, also disconnect breather pipe (2) on the tank.

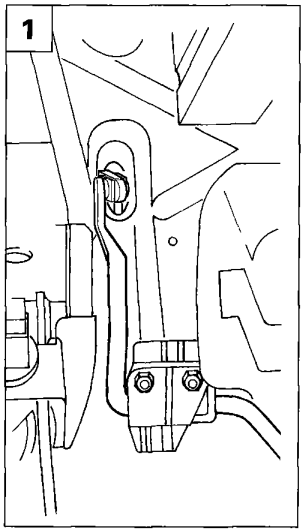



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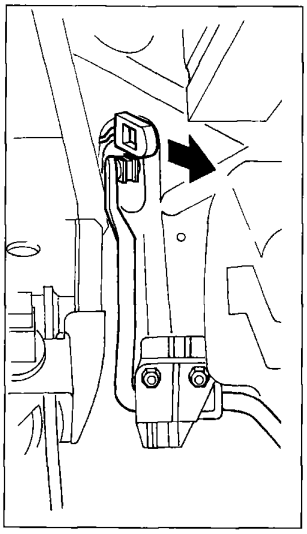
4. Fuel tank.

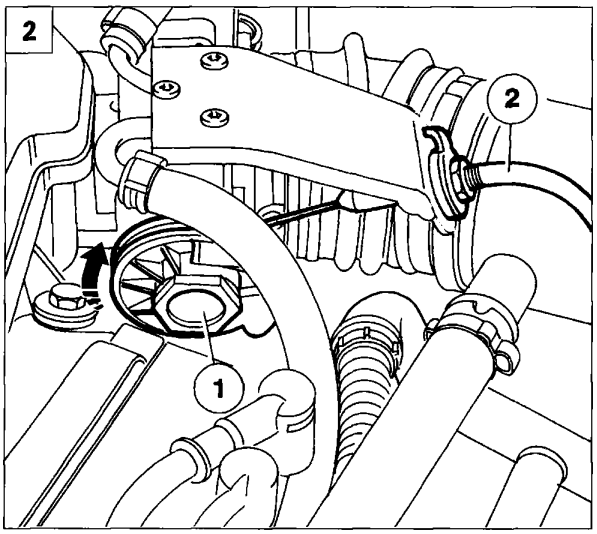


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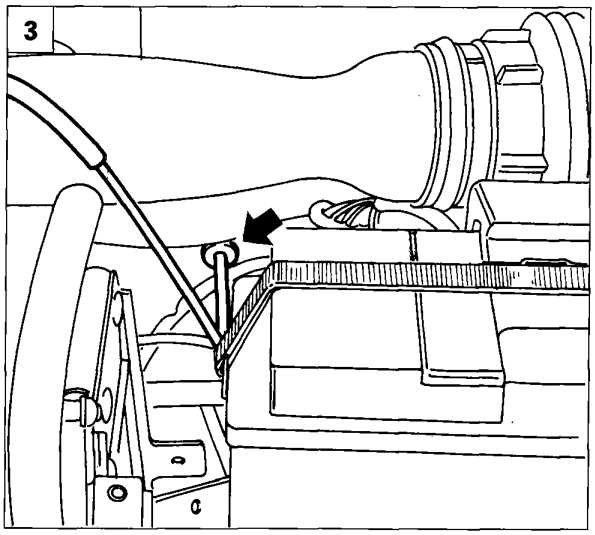


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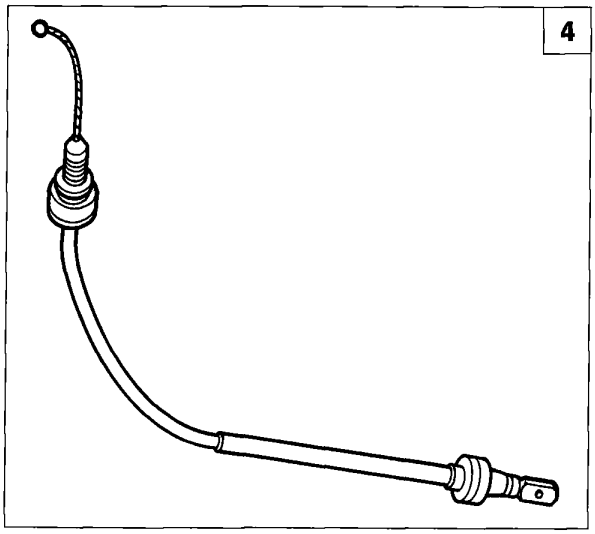

P4F56IJ02



P4F56IJ03



P4F56IJ04



P4F56IJ05

## REMOVING-REFITTING ACCELERATOR CABLE

Disconnect the battery lead, then proceed as follows:

1. Working from inside the vehicle, disconnect the control cable from its anchorage on the accelerator pedal.
2. In the engine bay, turn the throttle valve control lever (1) and disconnect the accelerator control cable. Then withdraw cable (2) from its support bracket.
3. Withdraw the flexible block from its anchorage hole on the dashboard bulkhead and remove the accelerator cable assembly.
4. Accelerator cable assembly.

*'After assembly, adjust the accelerator cable as described i the paragraph "Adjusting throttle cable".*



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## CHECKING ENGINE IDLE SPEED

If the engine idle speed is not 850 ± 50 rpm and the injection-ignition control unit is the self-regulating type, then it is not possible to carry out the adjustment, therefore it is necessary to check that the accelerator linkage is correctly adjusted and the fault should be sought through a complate fault diagnosis using the diagnostic equipment.

## CHECKING CONCENTRATION OF POLLUTANT EMISSIONS

Thanks to the auto-adjustment of the injection/ignition system, the idle speed and the CO percentage are continuously checked, thereby making any external adjustment operations superfluous (there are no longer any adjustment screws). However, a check on the content of the exhaust gases upstream and downstream of the catalyzer can provide precious indications on the operating conditions of the injection/ignition system and the catalyzer and engine parameters.

### Checking idle concentration of CO and HC upstream of the catalytic silencer

To check the concentration of carbon monoxide (CO) and unburnt hydrocarbons (HC) upstream of the catalyzer, proceed as follows:

1. Undo the cap or the nut on the exhaust pipe, upstream of the catalyzer, and tighten the tool in its place.
2. Connect a suitably calibrated CO tester probe to the tool.
3. Start up the engine and let it reach operating temperature.
4. Check that engine speed is correct.
5. Check that the idle CO concentration is within the limits in the table overleaf; if this is not the case, it is necessary to check:
   - that the Lambda sensor is working properly, using the diagnostic equipment;
   - the presence of air penetration in the area surrounding the Lambda sensor housing;
   - the injection and ignition system (**in particular the state of wear of the spark plugs**).
6. Under the same circumstances, check that the HC concentration is less than 600 p.p.m.
7. If these figures are not found, proceed with tuning the engine, in particular checking:
   - the ignition advance angle;
   - the valve clearances;
   - the valve gear timing;
   - the engine compression

### Pollutant emissions tolerance figures table

| | CO (%) | HC (p.p.m.) | $CO_2$ (%) |
|---|---|---|---|
| Upstream of the catalyzer | 0,4 ÷ 1 | 600 | ⩾ 12 |
| Downstream of the catalyzer | ⩽ 0,35 | ⩽ 90 | ⩾ 13 |

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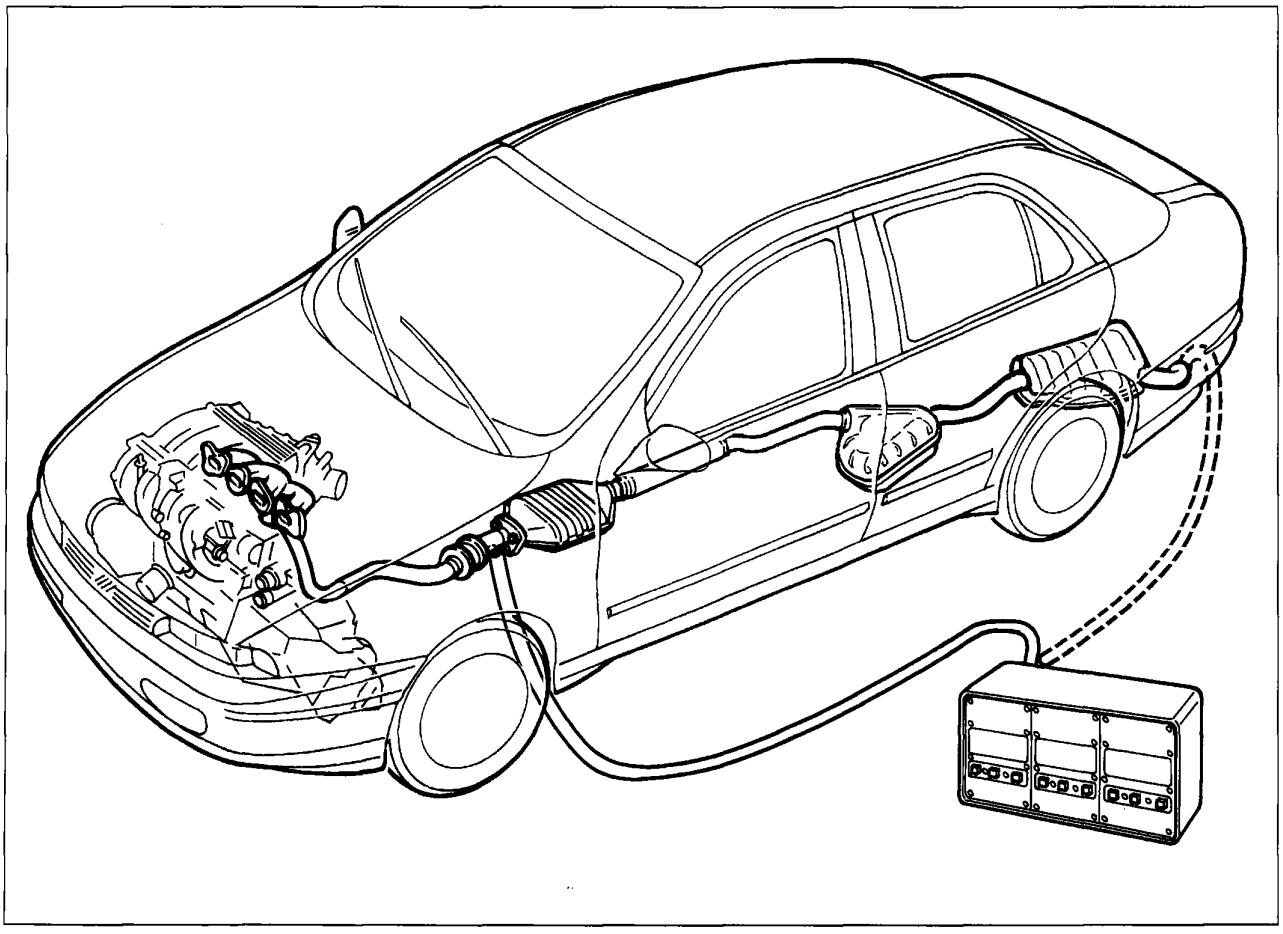
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**Checking CO and HC levels at exhaust**

To measure levels of carbon monoxide (CO) and unburnt hydorcarbons (HC) in exhaust emissions, insert the probe of an appropriately calibrated tester until at least 30 cm inside tail pipe.

If exhaust tail-pipe shape will not allow the probe to be fully introduced, add an extension pipe to ensure a seal in the joint area.

1. Check that idling CO and HC levels are as specified (see table)
2. If HC level is not as specified but level measured upstream of the catalytic converter was correct, it may be assumed that engine is correctly tuned and the fault lies in catalytic converter inefficiency.

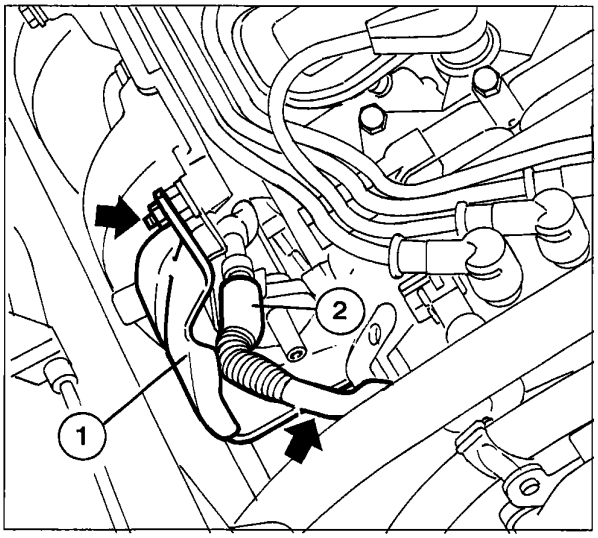


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## CHECKS ON FUEL FEED CIRCUIT



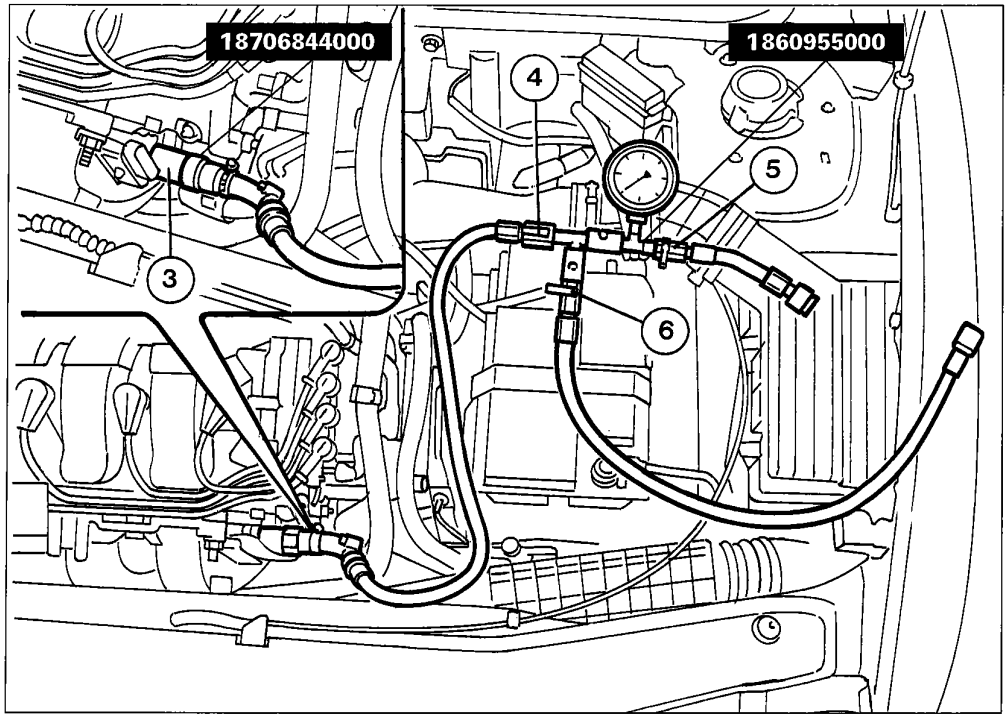
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**Checking fuel feed pressure**

Proceed as follows to check fuel feed pressure:
- undo retaining nuts indicated by arrows and remove bracket (1);
- disconnect injector supply connector (2);
- arrange cock (4) of tool 1860955000 in open position and cocks (5) and (6) in closed position;
- position device 1860955000 and connect to the fuel manifold by means of special adaptor 18706844000 (3) then reconnect injector supply connector (2);

**NOTE** *Device 1860955000 is fitted with adaptors for connection to different types of injection system. Fit the appropriate adaptors before making the connections.*

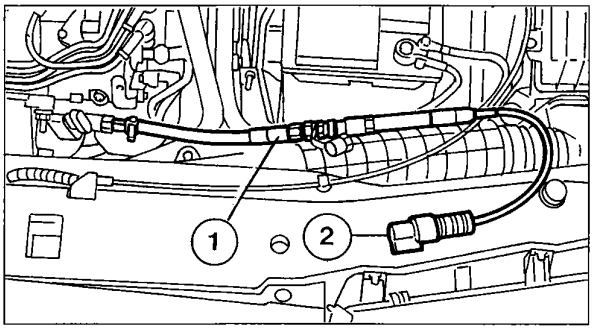
- start the engine and check that the pressure gauge reading is stable at 3 bar ± 0.2 bar when idling, then turn off the engine;
- operate the fuel pump with the engine off using a tester. Select fuel pump test when in active test mode;
- the pressure gauge should show a pressure increase of up to 4 bars.
- disconnect device 1860955000 from fuel manifold and refit bracket (1).



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**Checkign fuel feed pressure using a tester**

Fuel feed pressure can also be checked using an EXAMINER or SDC station. In this case, firstly remove the protective bracket as described in the previous paragraph, connect the tester to transducer (2), which must be connected to the fuel manifold via fitting (1).

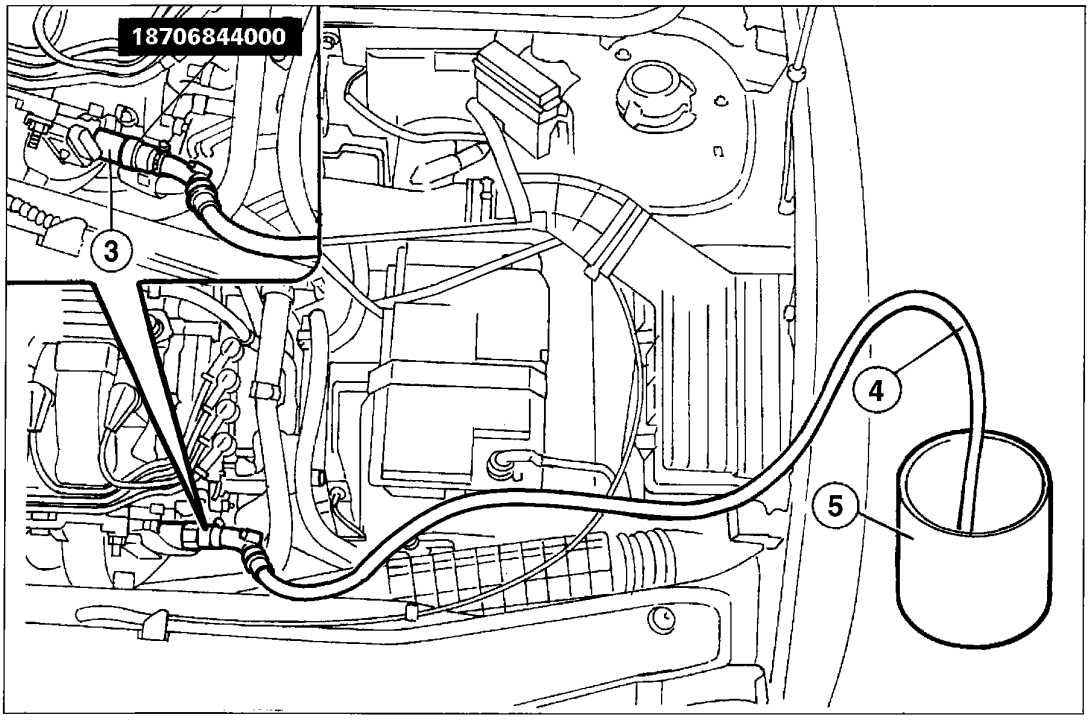
**Checking fuel consumption**

Check fuel consumption as follows:

- remove the protective bracket and disconnect injector supply connector as described in the previous paragraph on checking fuel feed pressure;

The fuel supply circuit is maintined at a constant pressure of 3 bar even when the engine is off. Before disconnecting the delivery pipe, therefore, drain off fuel under pressure as described below.

- obtain a suitable container (5) and place pipe (4) inside;
- connect the other end of line (4) to the fuel manifold using a special adaptor 18706844000 (3);
- drain fuel under pressure into container (5);
- disconnect adaptor (3) and fuel manifold pipe (4), then reconnect the injector supply connector;




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- disconnect the fuel delivery pipe from the quick-release fitting against the rear engine bay bulkhead and use fittings of tester 1860955000 to connect to a Flowtronic device (1806149001) as follows:

  1. Cut and withdraw end (A) of fitting (2), then connect end (B) to the fitting of rigid pipe (3) and end (A) to the Flowtronic inlet pipe (4).
  2. Insert fitting (5) into pipe section (6) and secure usinga steel collar. Then connect end (A) to pipe (1) disconnected previously and end (B) to the outlet pipe of Flowtronic device (4).

- carry out a fuel consumption road test in accordance with EU directive 93/116/CE (litres x 100 km):

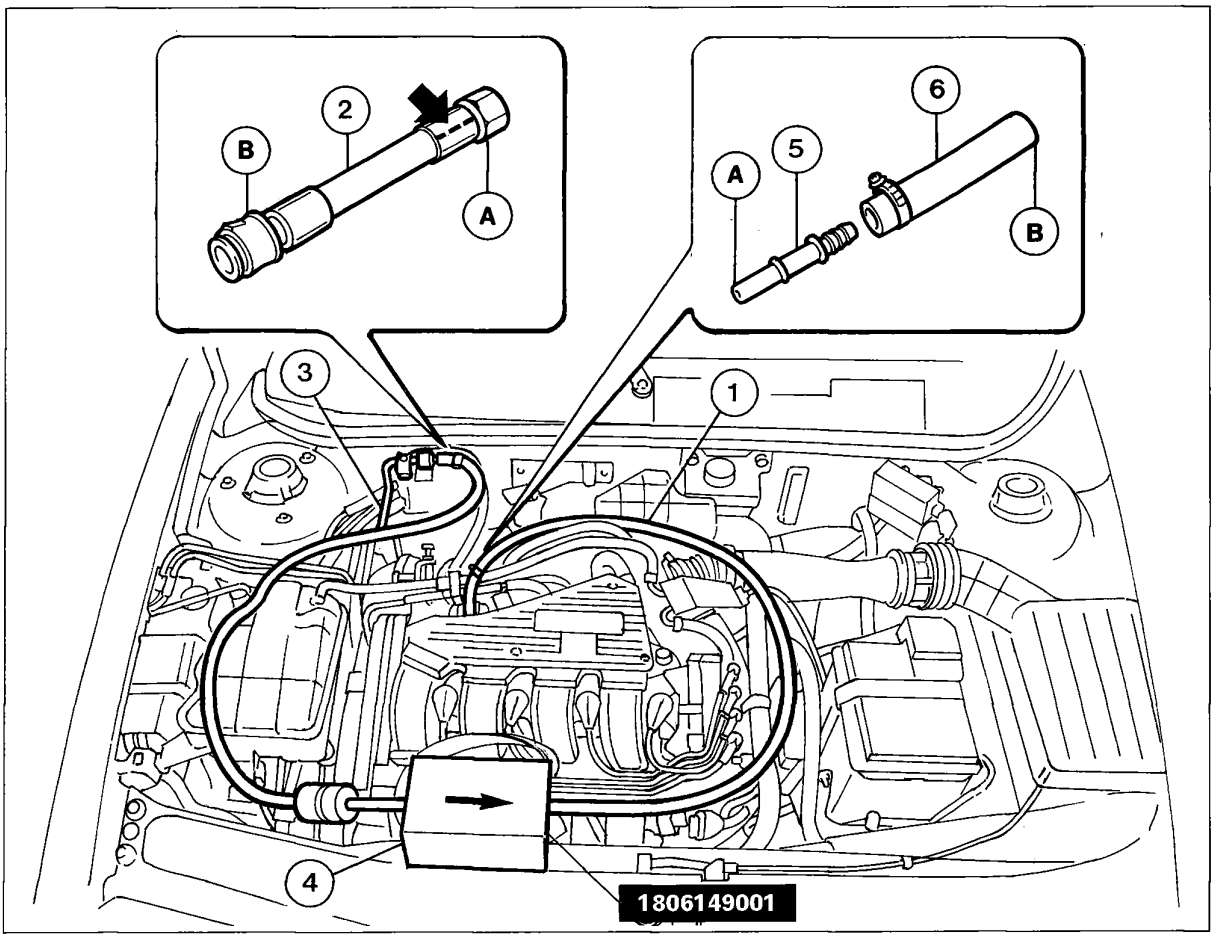
  URBAN CYCLE - includes a cold start followed by a simulated varied urban route.

  OUT-OF-TOWN CYCLE - includes frequent acelerations in all gears to simulate normal out-of-town vehicle use; speed ranges from 0 to 120 km/h.

  AVERAGE COMBINED FUEL CONSUMPTION - 37% of the urban cycle and 63% of the extraurban cycle.

**NOTE** *Type of route, traffic situations, driving style, weather conditions, version/equipment/accessory level, presence of a roof rack, presence of special equipment and vehicle condition in general, may lead to fuel consumption figures other than those measured as above.*

- check that the readings correspond to specifications in the "Introduction and technical data" section.




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# 10.

## FAULT DIAGNOSIS

Full fault diagnosis can be carried out on the injection-ignition system through active dialogue with an Examiner or SDC station.

If the sensors are found to be faulty, the electronic control unit replaces the faulty data output with a stored signal **(recovery)** so that the engine can continue to operate.

When a fault is detected, it is stored permanently and the sensor is cut off from the system until the signal is again compatible.

The same procedure is applied if the fault affects an actuator or actuator control port. When a fault is detected and replaced with a recovery value, the fault is indicated by means of a warning light on the instrument panel.

The following devices may be managed using the electronic control unit recovery system:

- Idle speed actuator
- Ignition coils
- Fuel vapour recirculation solenoid
- Pressure and air temperature sensor
- Coolant temperature sensor
- Knock sensor
- Throttle position sensor
- Lambda probe

In the case of control unit or rpm sensor faults, the system detects the fault but cannot replace it with a recovery value and the vehicle stalls. Anomalies may be detected in the control unit memory using an Examiner or SDC station.

### Error recognition and storage

An error is detected by means of a validation system, which works as follows:

When an error is detected, it is monitored for a time to rule out the possibilty of interference on the tester line. Once this stage is over, the error is considered to be present and stored in the RAM memory (filtered error). A check is then carried to ensure the error continues to be present for a further period of time. Once this stage is over, the error is stored permanently (validated error) and the fault warning light comes on. The error is written into the EEPROM memory after the ignition key has been turned back to STOP.

### Error frequency counter

A frequency counter is allocated to each error. This is used to determine the moment at which a fault which is no longer present was first stored. The first time a validated error is recorded, the counter is set at a fixed calibration value.

The counter is decreased whenever the vehicle is started up without the fault reappearing. If the counter goes down to zero, the fault is automatically deleted from the EEPROM memory.

### Error deletion

Errors may be deleted from the EEPROM memory in one of two ways:

- using a tester device (Examiner or SDC station), in active test mode
- by zeroing the error frequency counter.

**NOTE** *Data recorded in the EEPROM memory are not deleted when the control unit is disconnected from the system, even for long periods.*

### System fault warning light management

The control unit turns on the warning light to check it is working and keeps it on for 4 seconds whenever the ignition key is turned to MAR. The warning light is also lit whenever a validated error occurs - i.e. as long as the fault persists - and is turned off when the fault disappears.



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**Communication between control unit and tester**

A socket in the engine bay is used for connection of a tester device.
Information is exchanged between control unit and tester by means of a two-way tester line (K line) and the communicaiton protocol is to Key Word 2000 standards. Data are transmitted in NRZ positive logic at a rate of 10400 Bauds.
The tester can provide the following information:

- Engine parameter display;
- Error display;
- Active diagnosis.

**Displayed parameters**

Engine rpm
Injection time
Absolute pressure to inlet manifold
Inlet air temperature
Coolant temperature
Butterfly valve opening angle
Battery voltage
Number of engine idle speed actuator open/-close steps
Advance
Mixture correction (Lambda probe)
Vehicle speed
Self-adaptability
Error counter
Ignition coil load time (Dwell)
Petrol vapour solenoid
Start-up counter
Engine load
Fiat CODE

**List of errors**

| | |
|---|---|
| RPM sensor | Signal absent |
| Throttle potentiometer | A.C.-D.C. |
| Absolute pressure sensor | A.C.-D.C. |
| Air temperature sensor | A.C.-D.C. |
| Coolant temperature sensor | A.C.-D.C. |
| Battery | Power supply > 16.2V<br>Power supply < 6V |
| Lambda probe | Implausible signal<br>D.C. |
| Injectors | A.C.-D.C. |
| Ignition coils | A.C.-D.C. |
| Idle speed actuator | A.C.-D.C. |
| Fuel vapour solenoid | A.C.-D.C. |
| Actuator relays | A.C.-D.C. |
| Control unit | Microprocessor or ECU memory faults are indicated. |
| Self-adaptive parameters | Indication displayed when ECU self-adaptive limits reached.<br>This indicates that engine parameters are too far removed from specified values. It is therefore advisable to look for mechanical and other faults. |
| Speed sensor | Implausible signal<br>Speed greater than top speed |
| Knock sensor | A.C.-D.C. |
| Fiat CODE | Code not recognised or not received |

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# 10.

## Active diagnosis

When in active diagnosis mode, some components can be activated and certain specific functions can be carried out, e.g. the error deletion command described in the following table.

During active diagnosis, the ignition key must be turned to MAR and the engine must be running for certain functions.

| Function/Actuator | Activation mode |
|---|---|
| Electric fuel pump | Relay activation for 30 s |
| Injectors | Activation for 4 ms in each s for 5 times |
| Ignition coils | Activation for 2 ms in each s for 5 times |
| Error deletion command | Validated error deletion |
| Fuel vapour solenoid | Activation for 20 ms in each s for 7 times |
| Rev counter | Activation at 125 Hz for 2 s |
| Air conditioner relay | Relay activation for 30 s |
| Injection system failure warning light | Warning light activation for 30 s |
| Excessive coolant temperature warning light | Warning light activation for 10 s |
| Engine idle speed actuator | Activation for 32 forward/backward steps |
| Fiat CODE | Recovery procedure to allow engine start-up |
| Radiator fan | Activation for 10 s at both high and low speed |



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page

## FUEL SYSTEM

- Introduction 1
- General diagram of fuel system 2
- Location of components of fuel system 3
- Input/output signals between control unit and sensors/actuators 4
- Functional diagram of fuel system 6
- Air temperature sensor 7
- Engine coolant temperature sensor 7
- Hot-film air flowmeter 8
- Wiring diagram 10
- Control unit pins 12

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## INTRODUCTION

From chassis no. 205884, a new hot-film flowmeter has been adopted instead of the vane-type flowmeter.

The hot-film flowmeter is more precise and, as it has no moving parts, it is more reliable than the previous version.

With the introduction of the new flowmeter, other parts have also been affected by the modification; in addition to the hot-film flowmeter the new parts (added or modified) relating to the fuel system are as follows:

- Modified air duct connecting air cleaner to flowmeter.
- Modified air duct connecting flowmeter to turbine.
- Modified flowmeter mounting bracket.
- Replaced engine coolant temperature sender unit with a new sender unit which comprises two separate sensors: one for the fuel injection and one for the instrument panel gauge.
- Added intake air temperature sender unit which is no longer built into the flowmeter, but is a single component located upstream of the new hot-film flowmeter.
- Modified fuel injection pump: on the fuel outlet connection for the return to the tank, the 0.75 mm calibrated hole has been replaced with a valve calibrated at the pressure of about 4 bar; this allows the pump not to empty and to keep fuel under pressure in it, thus ensuring better engine starting.

- New Bosch 0.432.217.297 fuel injectors.
- New Bosch 0.432.217.296 instrumented fuel injector.
- New MSA 11 Bosch 0.281.001.741 fuel injection electronic control unit.
- New fuel injection wiring for connection to the new sensors.

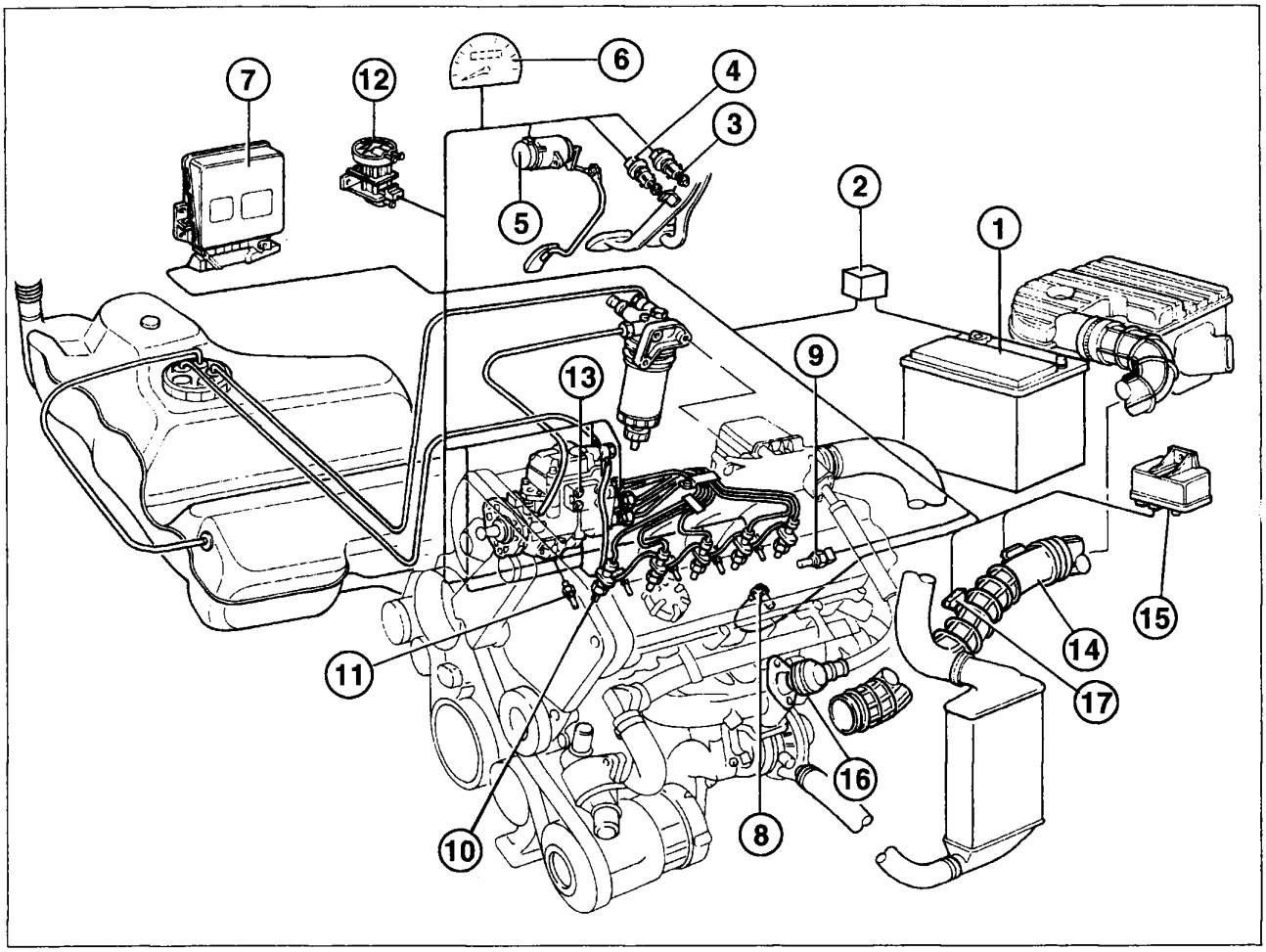
This section only covers the parts of the 2387 TD engine fuel system which are different in relation to the previous version.

For aspects not covered in the following pages, see the descriptions give in the "Fuel system of 2387 TD" in the basic edition, contained in volume 1.

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## GENERAL DIAGRAM OF FUEL SYSTEM



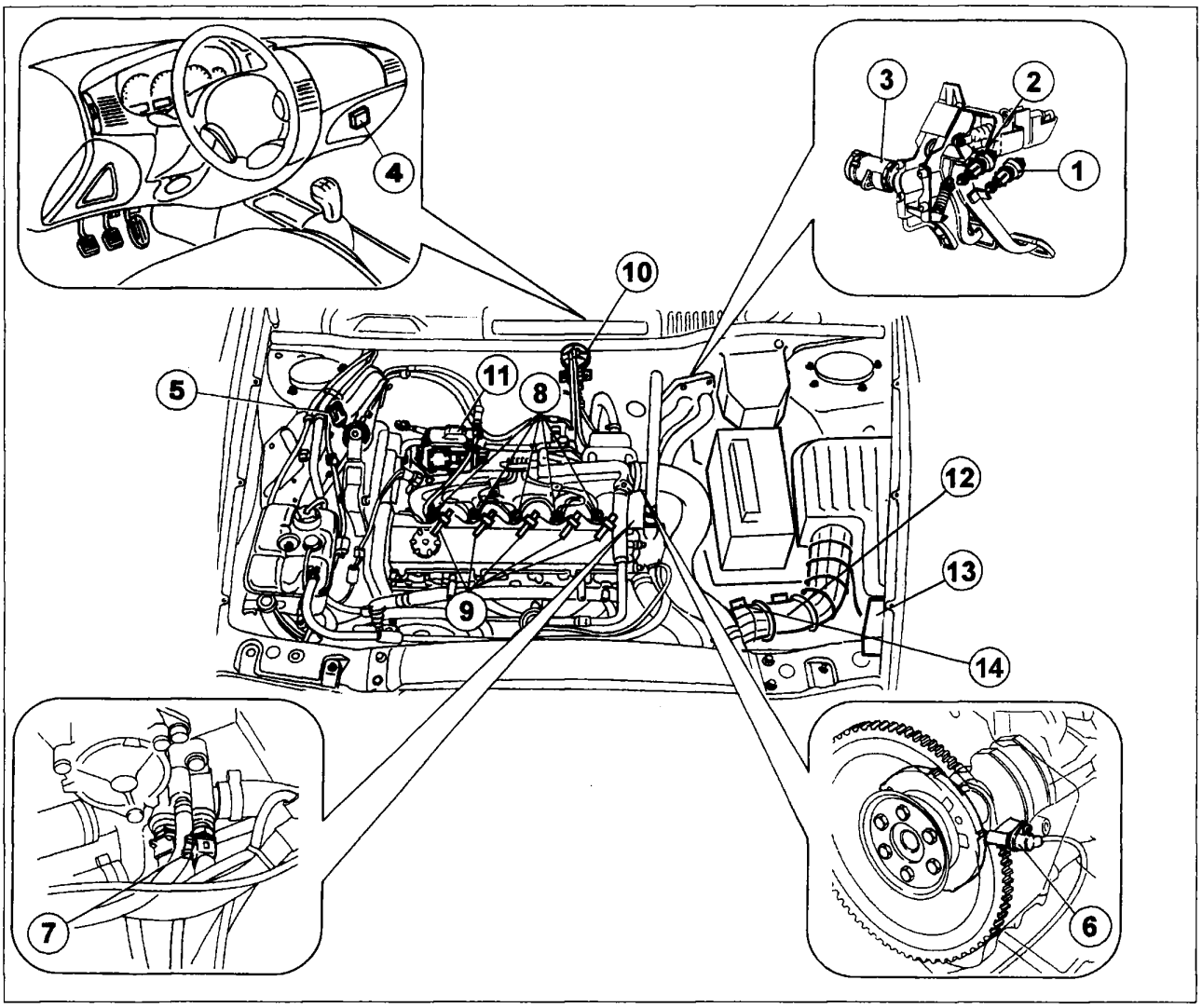

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1. Battery
2. Relay
3. Clutch pedal switch
4. Brake pedal switch
5. Accelerator potentiometer
6. Speedometer
7. Electronic control unit
8. Engine rpm sensor
9. Coolant temperature sensor
10. Instrumented fuel injector
11. Heater plugs
12. Borg-Warner modulating valve
13. Bosch fuel injection pump
14. Flowmeter
15. Plug preheating control unit
16. E.G.R. valve
17. Intake air temperature sensor



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## LOCATION OF FUEL SYSTEM COMPONENTS



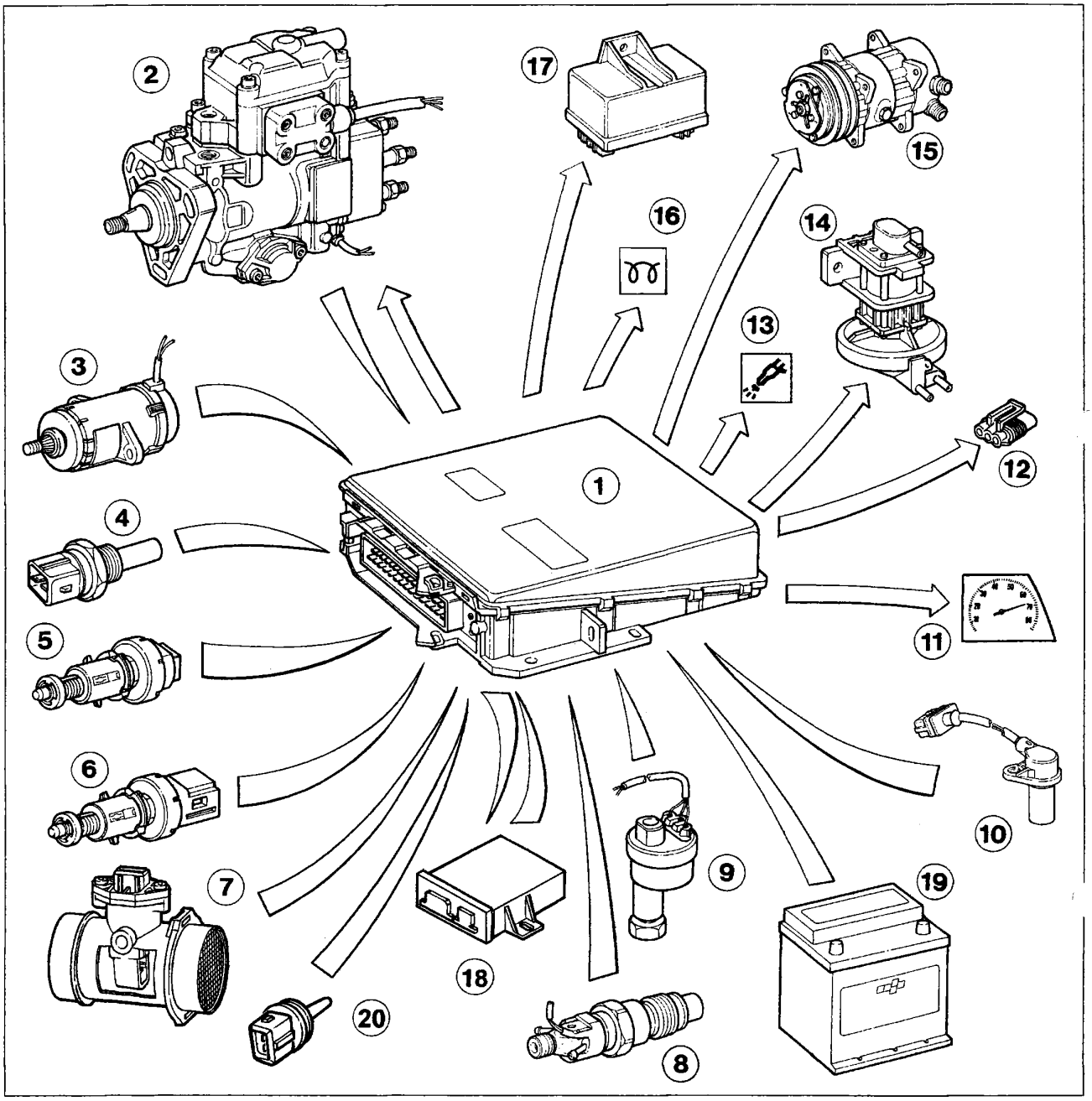

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1. Clutch pedal switch
2. Brake pedal switch
3. Accelerator potentiometer
4. Electronic control unit
5. Diagnostic socket
6. Engine rpm sensor
7. Coolant temperature sensor
8. Fuel injectors
9. Heater plugs
10. Borg Warner modulating valve
11. Bosch fuel injection pump
12. Flowmeter
13. Plug preheating control unit
14. Intake air temperature sensor

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## INPUT/OUTPUT SIGNALS BETWEEN CONTROL UNIT AND SENSORS/ACTUATORS




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1. Electronic control unit
2. Injection pump
3. Accelerator pedal potentiometer
4. Engine coolant temperature sensor
5. Clutch pedal switch
6. Brake pedal switch
7. Air flowmeter
8. Instrumented fuel injector
9. Speedometer sensor
10. Engine rpm sensor
11. Rev counter
12. Diagnostic socket
13. Fuel injection fault warning light
14. Borg Warner solenoid
15. Air conditioner
16. Heater plugs warning light
17. Plug preheating control unit
18. Fiat CODE control unit
19. Battery
20. Intake air temperature sensor



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The BOSCH MSA11 electronic control unit (1) receives the following information:

- accelerator pedal position from the potentiometer connected to it (3);
- engine rpm from the sensor mounted on the engine block (10);
- intake air quantity from the flowmeter (7);
- quantity of fuel injected from the sensor mounted on the actuator contained in the fuel injection pump (2);
- intake air temperature from the relevant sensor (20);
- diesel temperature from the sensor located in the fuel injection pump (2);
- coolant temperature from the sensor (4);
- actual start of injection (opening of fuel injector pintle) from the instrumented fuel injector (8), located on cylinder 1;
- car speed from speedometer sensor (9) located on the gearbox;
- brake operation information from the switch (6) located on the brake pedal;
- clutch operation from the switch (5) located on the clutch pedal;
- atmospheric pressure from the sensor located inside the control unit (1);
- signal requesting the switching on of the air conditioner compressor from the air conditioning system (15).

Depending on the input values, the electronic control unit (1) consults the mapped values in its memory and corrects the output values accordingly, thus managing:

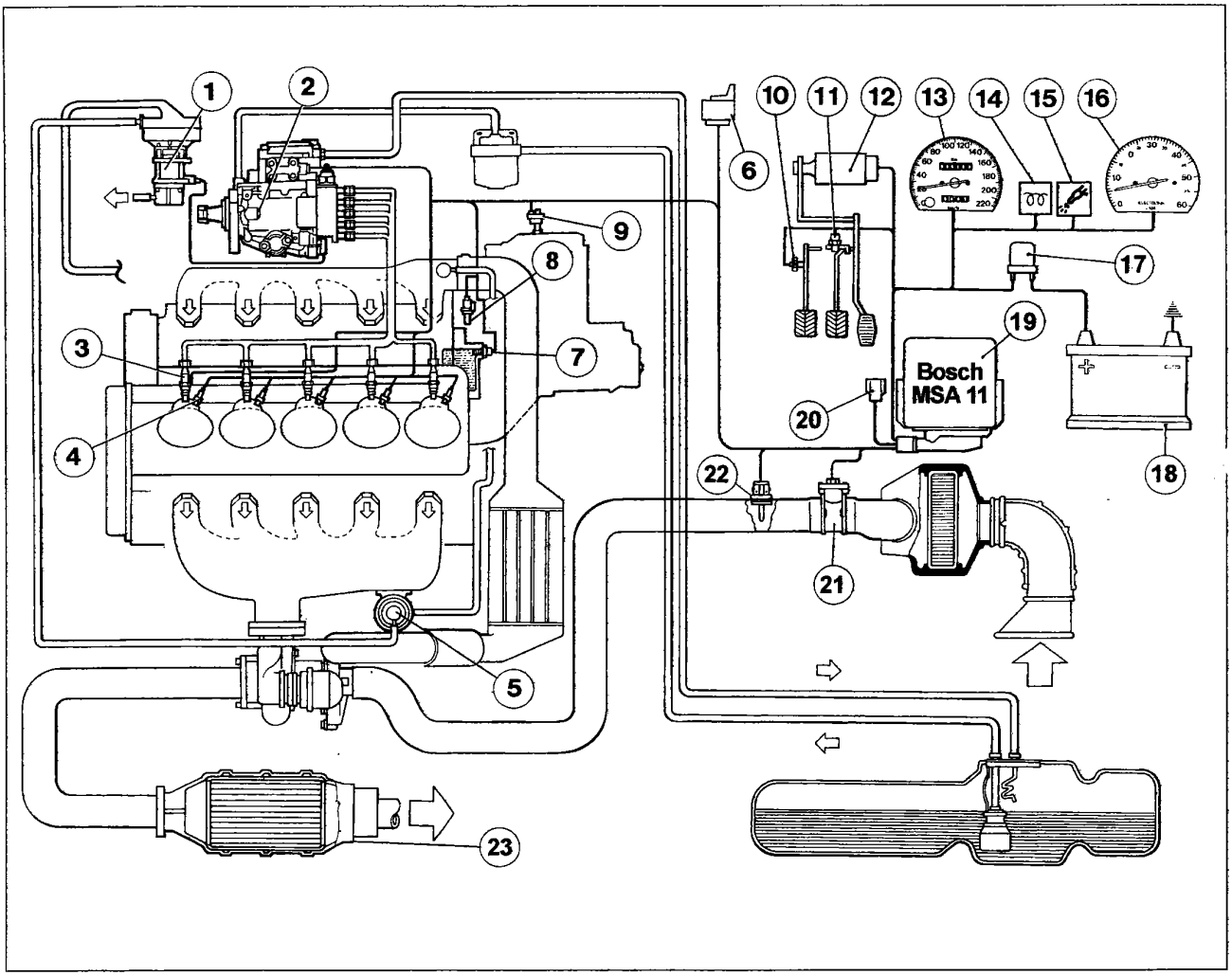
- the actuator controlling the quantity of fuel contained in the fuel injection pump (2);
- the fuel injection advance regulation solenoid contained in the fuel injection pump (2);
- the engine stop solenoid contained in the fuel injection pump (2);
- the heater plug control unit (17);
- the Borg Warner (14) vacuum modulating solenoid controlling the E.G.R. valve;
- the heater plugs warning light (16);
- the fuel injection fault warning light (13);
- the rev counter (11);
- the engagement of the air conditioner compressor electromagnetic clutch (15);
- the diagnostic socket (12).

The control unit also has the function of blocking engine starting (Fiat CODE).
This function is carried out by a specific control unit (Fiat CODE) (18), which can dialogue with the electronic control unit (1), and an electronic key with a special transmitter for sending a recognition code.

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## FUNCTIONAL DIAGRAM OF THE FUEL SYSTEM

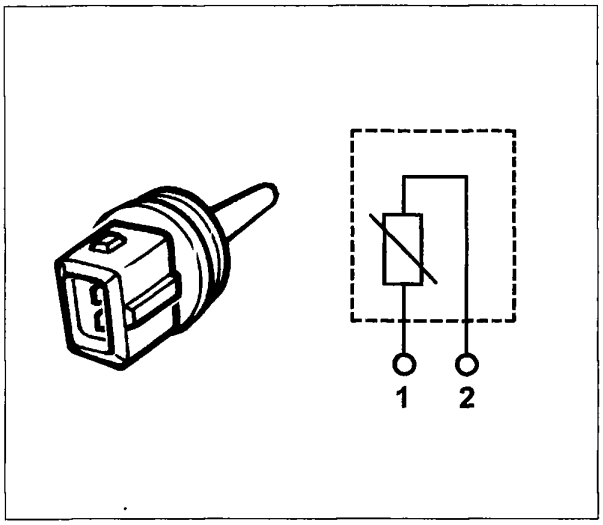



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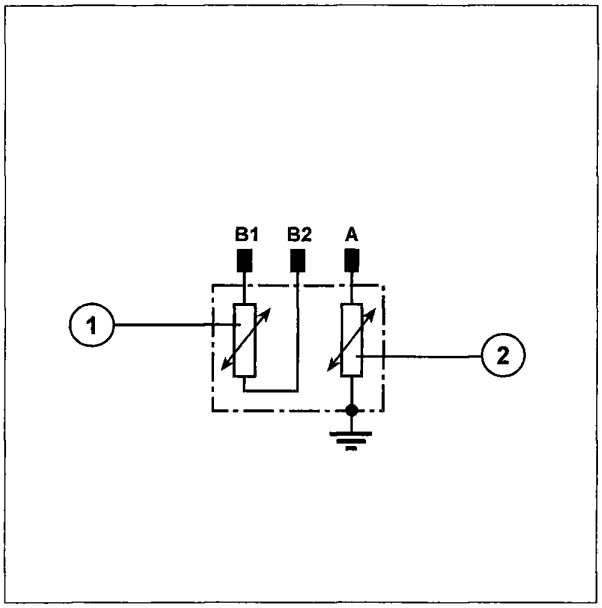
1. Borg Warner modulating valve
2. Bosch fuel injection pump
3. Instrumented fuel injector
4. Heater plug
5. EGR valve
6. Plug preheating control unit
7. Coolant temperature sensor
8. Engine rpm sensor
9. Speed sensor
10. Clutch pedal sensor
11. Brake pedal sensor
12. Accelerator potentiometer
13. Speedometer
14. Heater plug warning lamp
15. Fuel injection fault warning light
16. Rev counter
17. Relay
18. Battery
19. Fuel injection control unit
20. Diagnostic socket
21. Air flowmeter
22. Intake air temperature sensor
23. Catalytic converter



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## AIR TEMPERATURE SENSOR

On this version, the intake air temperature sensor is separate from the air flowmeter; it is an ordinary NTC (Negative Temperature Coefficient) sensor, whose electrical resistance decreases as temperature increases.

As the input circuit into the control unit is designed as a voltage divider, this voltage is divided between a resistor present in the control unit and the sensor's NTC resistor. The control unit can therefore assess the changes in the sensor's resistance from the changes in voltage, and thus obtain the temperature information.

## COOLANT TEMPERATURE SENSOR

The sensor consists of a brass casing which houses the actual resistive elements, which are two NTC (Negative Temperature Coefficient) thermistors; the electrical resistance of the sensor decreases as the temperature increases.
The two NTC thermistors are separate, and they supply the temperature information to the specific gauge on the instrument panel and the fuel injection-ignition control unit.
For the NTC element relating to the fuel injection, the reference voltage is 5 Volt; as the input circuit into the control unit is designed as a voltage divider, this voltage is divided between a resistor present in the control unit and the sensor's NTC resistor. The control unit can therefore assess the changes in resistance of the sensor through the changes in temperature.

1. NTC for fuel injection
2. NTC for instrument panel gauge

The tables opposite give the resistance values which the NTC elements can assume in accordance with the coolant temperature.

**INJECTION NTC**

| °C | Ω | °C | Ω |
|---|---|---|---|
| -20 | 15970 | 40 | 1150 |
| -10 | 9620 | 50 | 807 |
| 0 | 5975 | 60 | 576 |
| 10 | 3816 | 70 | 418 |
| 20 | 2500 | 80 | 309 |
| 25 | 2044 | 90 | 231 |
| 30 | 1679 | 100 | 176 |

**GAUGE NTC**

| °C | Ω |
|---|---|
| 60 | 512-602 |
| 90 | 184-208 |
| 120 | 76-88 |



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# 10.

## HOT-FILM AIR FLOWMETER

This component measures the quantity of air drawn in by the engine. The electrical signal (proportional to the air flow) which the flowmeter gives as an output is sent to the engine control unit. This is used to:
- calculate the quantity of fuel to be injected, so as to obtain the maximum fuel flow rate while maintaining an acceptible level of smoke in the exhaust;
- check the quantity of gases recirculating through the EGR valve.

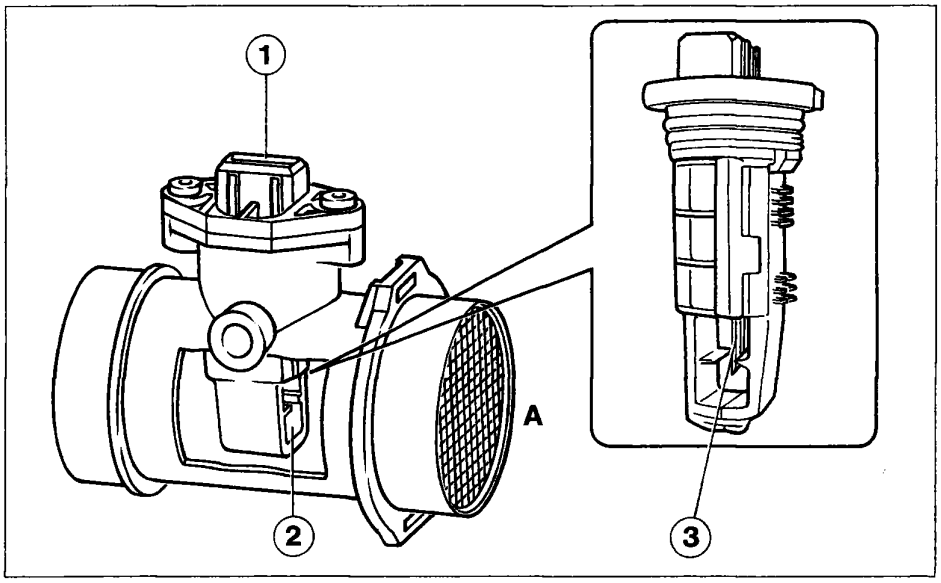
The check on the quantity of recirculating gases is based on the following equation:

**Qam - Qar = Qgr**

Qam = quantity of theoretical air mapped in the control unit in a particular point of engine operation;
Qar = quantity of air which really passes through the flowmeter (and is drawn in by the engine) at the same point of engine operation;
Qgr = the imbalance, compared with the theoretical value, of the quantity of recirculating gases.

If the quantity of recirculating gases is correct for a particular point of engine operation, the quantity of air drawn in by the engine must be the same as the mapped quantity. Thus Qgr must be zero. If Qam is greater than Qar, this means that the quantity of air passing through the flowmeter is less than the theoretical quantity, i.e. the quantity of recirculating gases is higher than the specified value (Qgr > 0). In this case the control system intervenes on the EGR valve to reduce the flow rate, so that the Qgr value is cancelled.

The system behaves in the same way if Qar > Qam.




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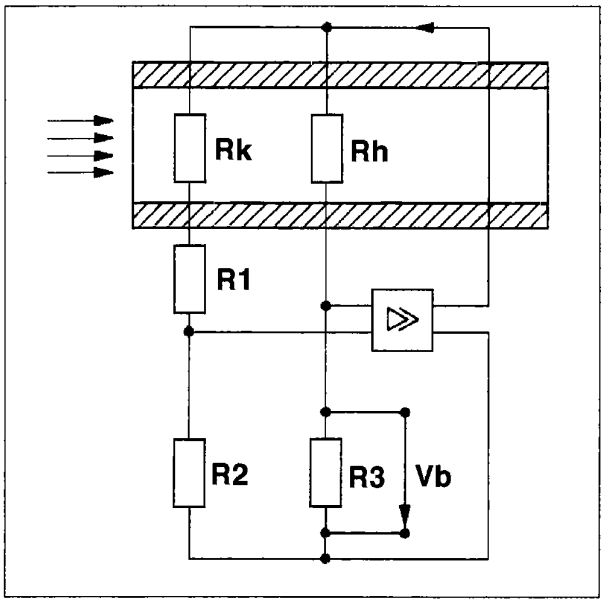
1. Connector
2. Measuring channel
3. Hot-film sensor
A = Air input

The "hot-film" air flowmeter.
The operating principle of these sensors is based on the heat exchange between a "hot" element and the air flow enveloping it.
The heat exchanged is given by the electrical power supplied by the power supply to the hot element, to keep its temperature constant.



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The principle of operation of the flowmeter may be observed from the following wiring diagram of the electrical circuit which drives the sensor:




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Wiring diagram

Rh = hot film

Rk = temperature compensation sensor

R1, R2, R3 = bridge resistors

In the diagram, the component Rh represents the hot sensor, which is kept at constant temperature in relation to the air temperature.
An increase in the quantity of air enveloping the hot element causes it to cool down, and so reduces its resistance, unbalancing the bridge.
The circuit restores the balance of the bridge by increasing the current supplied to the hot element until its resistance (and so its temperature) assumes the original balanced value.
The increase in current which passes through the hot element is proportional to the air flow passing through the flowmeter. This value thus gives the air flow: to measure precisely the current passing through the hot film, the voltage at the ends of the fixed resistor R3 is measured; this voltage thus provides the information on the mass of air passing through the flowmeter.

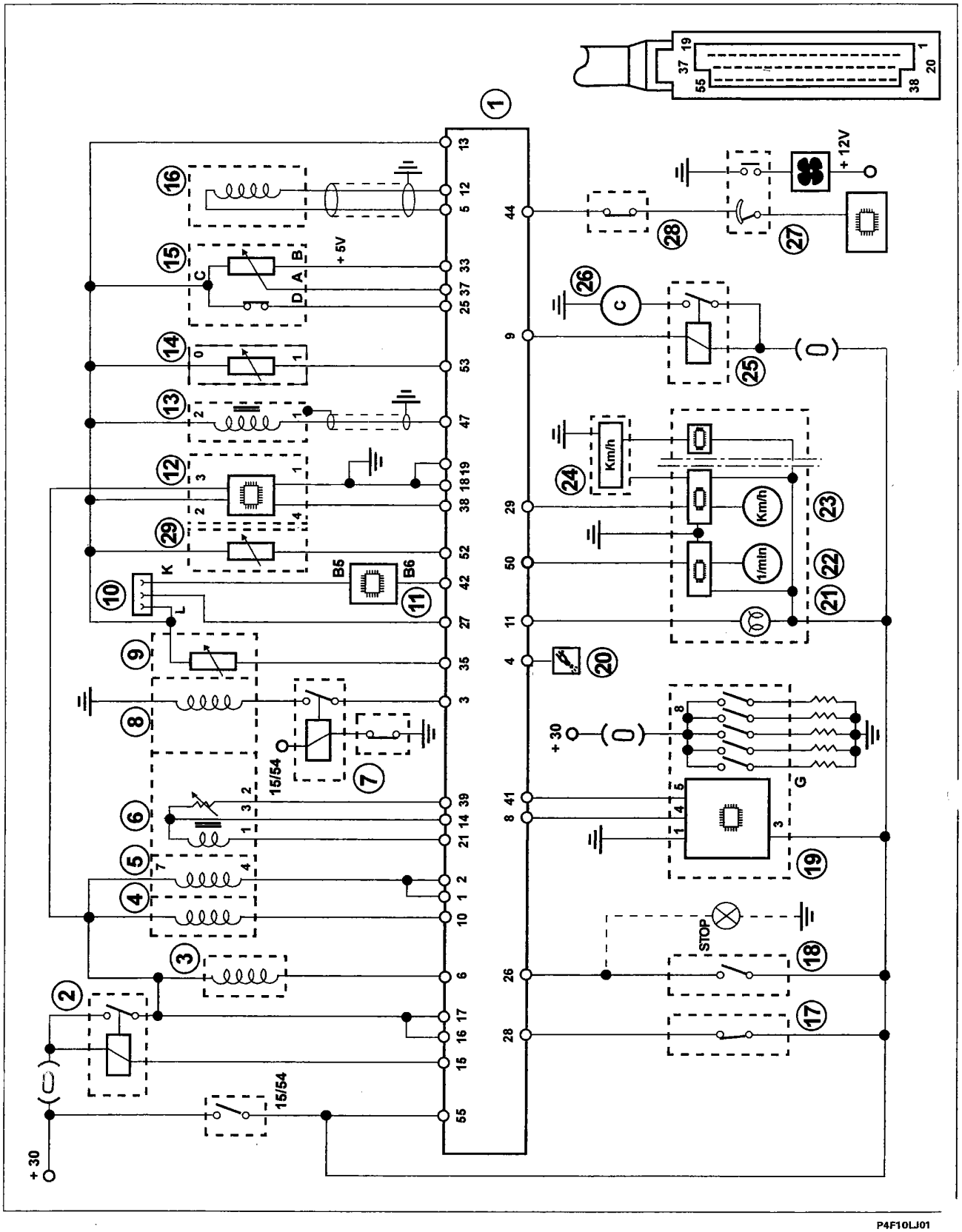
To compensate for the measurement error due to the variation in air temperature, the resistor Rk is in parallel to the hot film. Its high value only changes when the air temperature changes, compensating for the increase in resistance of the hot sensor, so the bridge does not undergo unbalancing due to the variation in the air temperature.

The hot element consists of platinum. For the same area, film technology offers shorter response times than hot wire. In addition, having a larger area than wire, it has greater immunity to inorganic contamination.

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## WIRING DIAGRAM

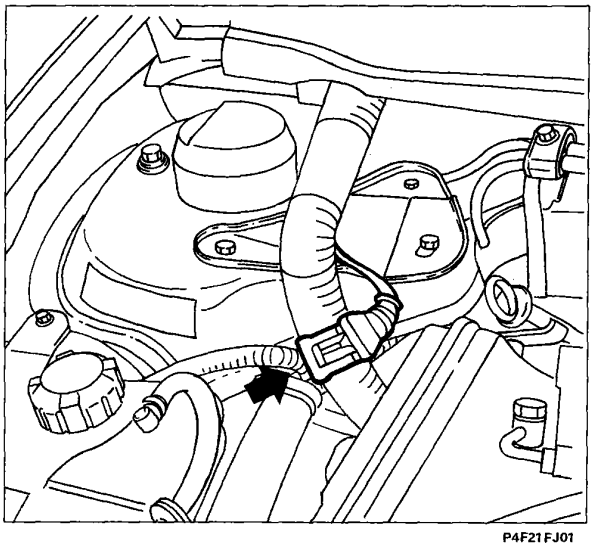





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**Key to wiring diagram**

1. Electronic control unit
2. System protection relay
3. Borg-Warner modulating solenoid
4. Fuel injection advance actuator
5. Fuel quantity actuator
6. Fuel quantity actuator position control
7. Inertial switch
8. Engine cut-out solenoid
9. Fuel temperature sensor
10. Diagnostic socket
11. Immobilizer
12. Flowmeter
13. Engine rpm sensor
14. Engine coolant temperature sensor
15. Accelerator pedal potentiometer with idle switch
16. Instrumented fuel injector
17. Clutch pedal switch
18. Brake pedal switch
19. Plug preheating electronic control unit
20. System fault warning light
21. Plug preheating warning light
22. Rev counter
23. Speedometer
24. Speedometer sensor
25. Air conditioner compressor relay
26. Air conditioner compressor
27. Three-stage pressure switch
28. Anti-frost thermostat
29. Air temperature sensor



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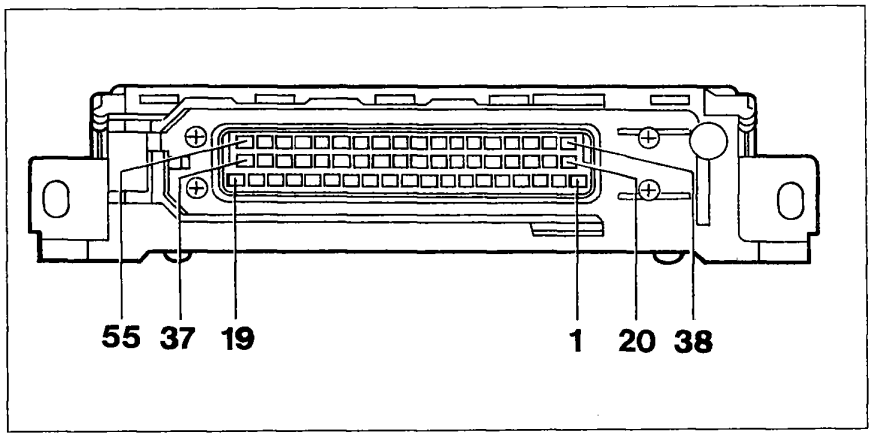
Location of diagnostic socket

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## CONTROL UNIT PINS




1. Fuel flow actuator
2. Fuel flow actuator
3. Engine cut-out solenoid
4. Infocenter
5. Instrumented fuel injector
6. E.G.R. solenoid
7. Not connected
8. Activation of plug preheating control unit
9. A.C. compressor
10. Fuel injection advance actuator
11. Heater plugs "on" warning light
12. Earth for instrumented fuel injector
13. Sensors' shared earth
14. Cursor position sensor
15. Main relay
16. Control unit supply through relay
17. Control unit supply through relay
18. Earth
19. Earth
20. Not connected
21. Cursor position sensor (reference winding)
22. Not connected
23. Not connected
24. Not connected
25. Idle switch on accelerator pedal
26. Stop lights switch
27. Not connected
28. Clutch pedal switch
29. Vehicle speed signal
30. Not connected
31. Not connected
32. Not connected
33. 5V accelerator pedal position sensor
34. Not connected
35. Fuel temperature signal
36. Not connected
37. Accelerator pedal position signal
38. Flowmeter signal
39. Cursor position sensor signal
40. Not connected
41. Heater plug operation signal
42. Line K and immobilizer
43. Not connected
44. Signal required for switching on compressor
45. Not connected
46. Not connected
47. Engine rpm sensor
48. Not connected
49. Not connected
50. Rev counter signal
51. Not connected
52. Air temperature signal
53. Engine coolant temperature signal
54. Not connected
55. Ignition key positive



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ENGINE CONTROL UNIT 54

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## BOSCH M1.5.5 INTEGRATED INJECTION/IGNITION SYSTEM

### Introduction

The BOSCH M1.5.5 system fitted on the 1242 16v engine belongs to the category of static advance digital electronic ignition systems integrated with phased multiple intermittent type electronic fuel injection systems.
The integrated system can be summarized in the following sub-systems:

ELECTRICAL/ELECTRONIC CIRCUIT
AIR INTAKE CIRCUIT
FUEL SUPPLY CIRCUIT
EMISSION CONTROL DEVICES

- The system is capable of detecting the following parameters by means of suitable sensors:
- the engine rotation speed;
- the correct sequence of TDC for the explosion stroke in the cylinders (injection timing);
- the absolute pressure in the inlet manifold;
- the temperature of the intake air;
- the position and the variation speed of the accelerator butterfly position;
- the temperature of the engine coolant;
- the possible presence of detonation;
- the speed of the vehicle;
- the battery voltage;
- whether the air conditioning is switched on;
- whether the power steering is in the end of travel position;

This information, usually in analogue format, is converted into digital signals by analogue/digital converters (A/D) in order to be able to be used by the control unit.

The control unit memory contains the management programme (software) which consists of a series of strategies, each of which manages a precise system control function.

Using the information (input) listed previously, each strategy processes a series of parameters using data maps stored in special areas of the control unit memory and then controls the system actuators (output) which consist of devices which allow the engine to operate, namely:

injectors;

relay feeds;

implementation fan;

interface with the vehicle (diagnostic warning light, diagnostic instrument, etc.).

**NOTE** *The BOSCH M1.5.5 injection/ignition system does not require any adjustments as it is the self-regulating type.*

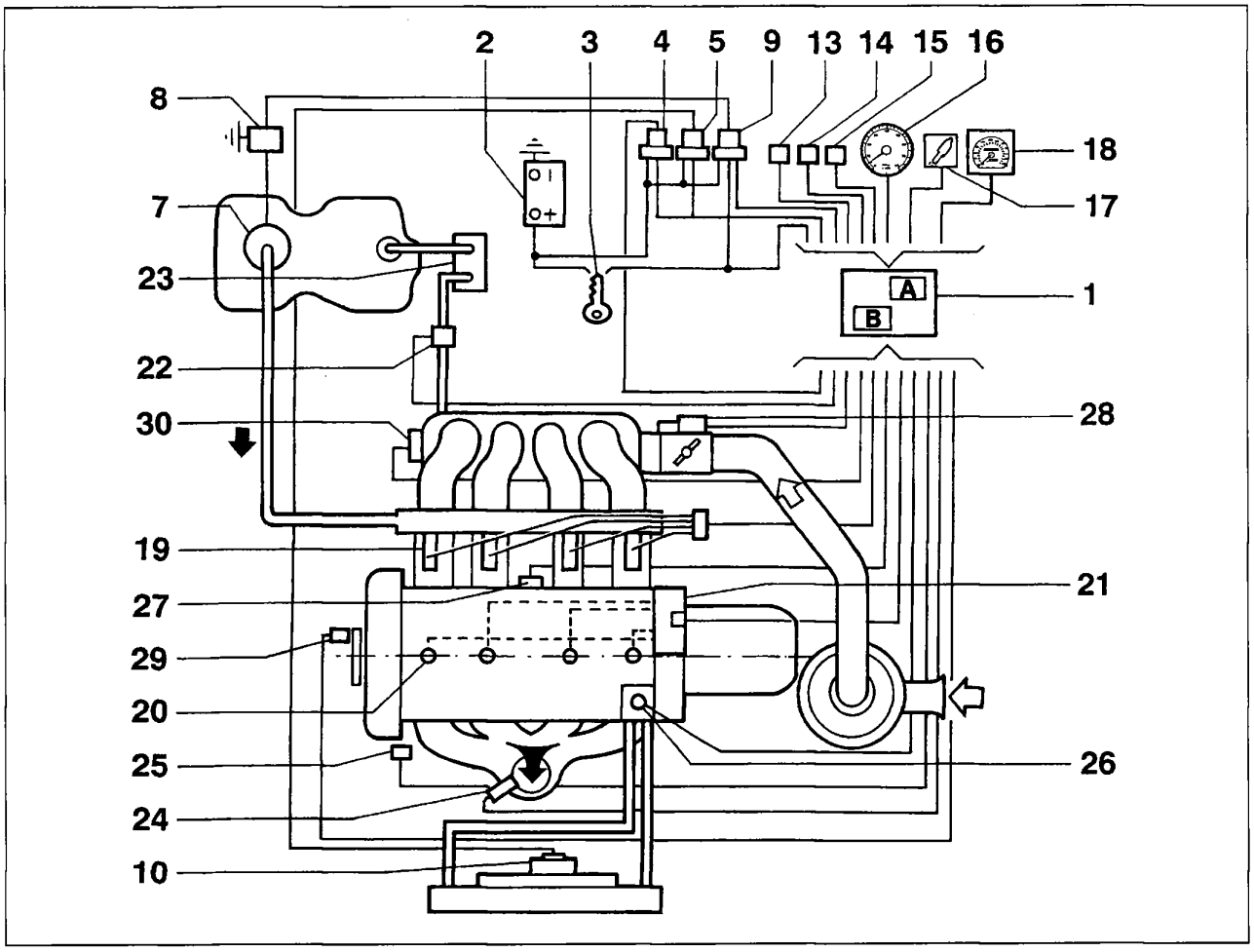
**NOTE** *The numbers in the drawings and the diagrams indicate the corresponding pins for the engine control unit (number/A for connector A, number/B for connector B).*

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## BOSCH M1.5.5 INJECTION/IGNITION SYSTEM FUNCTIONAL DIAGRAM



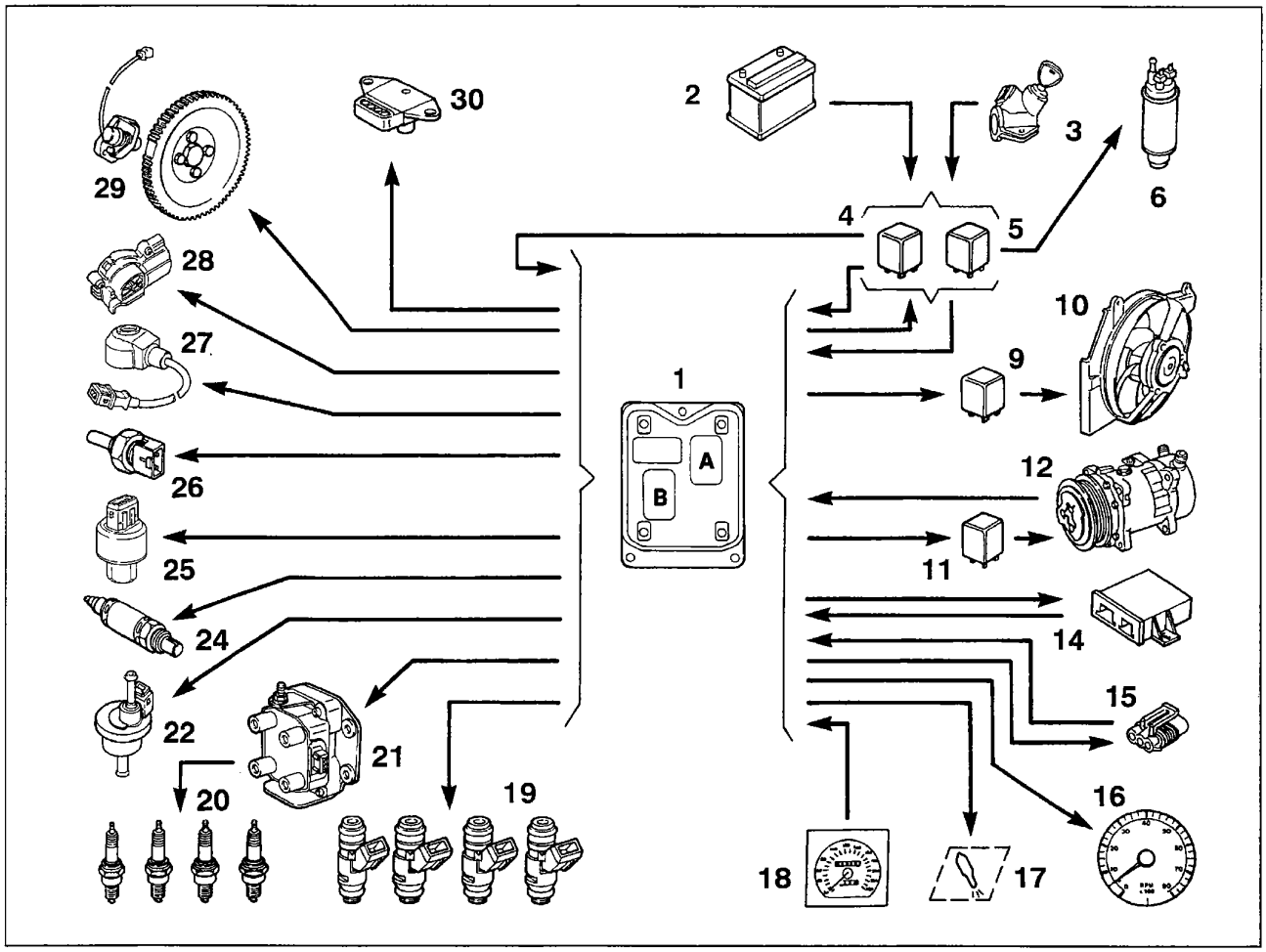

4F002PJ01

1. Engine control unit
2. Battery
3. Ignition switch
4. Engine control system relay
5. Electric fuel pump relay
7. Drip tray (including: electric pump, pressure regulator, filter, gauge)
8. Inertia switch
9. Radiator fan relay(s)
10. Radiator fan
13. Climate control connection
14. CODE connection
15. Diagnostic equipment connection
16. Rev counter
17. System failure bulb
18. Speedometer
19. Injectors
20. Spark plugs
21. Ignition coil
22. Charcoal filter scavenging solenoid valve
24. Lambda sensor
25. Power assisted steering sensor
26. Coolant temperature sensor
27. Detonation sensor
28. Engine idle adjustment actuator and butterfly position sensor
29. Engine rpm and TDC sensor
30. Absolute pressure and air temperature sensor



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## DIAGRAM SHOWING INFORMATION ENTERING/LEAVING THE CONTROL UNIT AND SENSORS/ACTUATORS FOR THE BOSCH M1.5.5 INJECTION/IGNITION SYSTEM



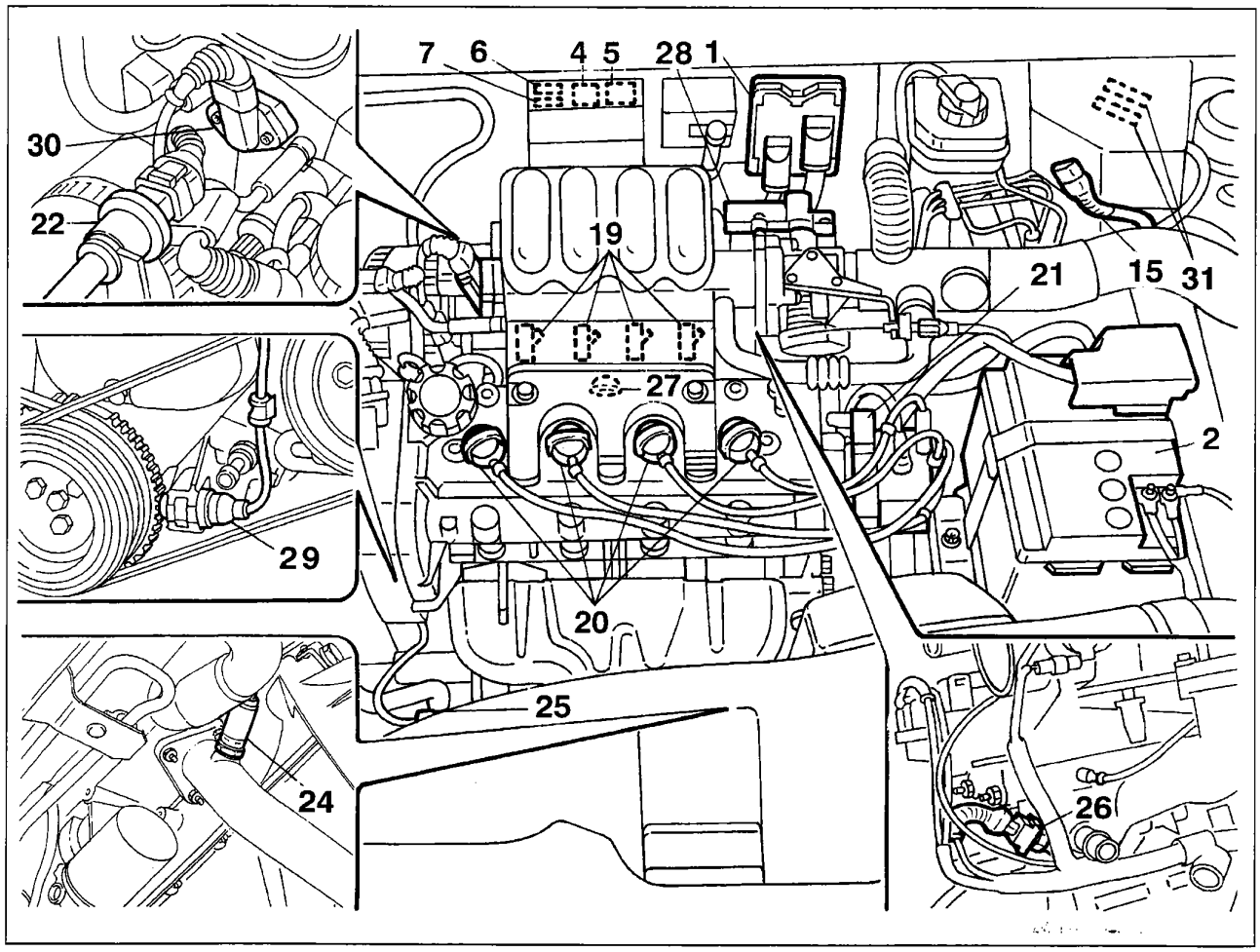

4F003PJ01

1. Engine control unit
2. Battery
3. Ignition switch
4. Engine control system relay
5. Electric fuel pump relay
6. Electric fuel pump
9. Radiaor fan relay(s)
10. Radiator fan
11. Compressor engagement relay
12. Compressor
14. CODE control unit
15. Diagnostic equipment connection
16. Rev counter
17. System failure light
18. Speedometer
19. Injectors
20. Spark plugs
21. Ignition coil
22. Charcoal filter scavenging solenoid valve
24. Lambda sensor
25. Power assisted steering sensor
26. Coolant temperature sensor
27. Detonation sensor
28. Engine idle adjustment actuator and butterfly position sensor
29. Engine rpm and TDC sensor
30. Absolute pressure and air temperature sensor

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## LOCATION OF BOSCH M1.5.5 INJECTION/IGNITION SYSTEM COMPONENTS IN THE ENGINE COMPARTMENT




4F004PJ01

1. Engine control unit
2. Battery
4. Engine control system relay
5. Electric fuel pump relay
6. System fuse
7. Electric pump fuse
15. Diagnostic equipment connection
19. Injectors
20. Spark plugs
21. Ignition oil
22. Charcoal filter solenoid valve
24. Lambda sensor
25. Power assisted steering sensor
26. Coolant temperature sensor
27. Detonation sensor
28. Engine idle speed adjustment actuator and butterfly position sensor
29. Engine rpm and TDC sensor
30. Absolute pressure and air temperature sensor
31. Main fuses (maxi-fuse)



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## SYSTEM MANAGEMENT STRATEGIES

### Operating principle

Any engine operating point is identified by two parameters:

- rotation speed;
- engine load.

If these parameters are known through suitable processing it is possible to calculate and then implement the injection (quantity of fuel supplied and timing with TDC in explosion stroke), the ignition (correct ignition advance) and any other functions for each engine operating point.

In the BOSCH M1.5.5 system the rotation speed is measured directly through the sensor whilst the engine load is determined indirectly by calculating a "tl factor" (representing the actual engine load) according to the absolute pressure and temperture of the air, both measured in the inlet manifold.
During experiments on the engine and the vehicle special maps are produced for the injection and the ignition which contain the injection and ignition advance timing for the correct operation of the engine (for a certain number of pairs of speed/load parameters).
For any engine operating point not included exactly amongst the values stored in the memory, the figures are determined by mathematical interpolation.

The injection times calculated are also corrected according to the signal coming from the Lambda sensor which, according to suitable operating strategies, determines a continuous fluctuation of the mixture strength around the stoichiometric value.
The system is therefore defined as the speed-density-Lambda type because the injection is basically determined by these three parameters.

All the particular operating situations which require special adjustments to the injection timing and ignition advance values calculated are managed by the engine control unit according to the signals coming from the various system senors.

### Management of the signals

**NOTE** *The term "signals" refers to the collection of signals coming from the sensor on the crankshaft which feature a precise sequence which the control unit is capable of recognizing.*

During starting, the control unit recognizes the injection and ignition timing which is fundamental for the subsequent operation of all the strategies.
This recognition takes place in two successive stages:

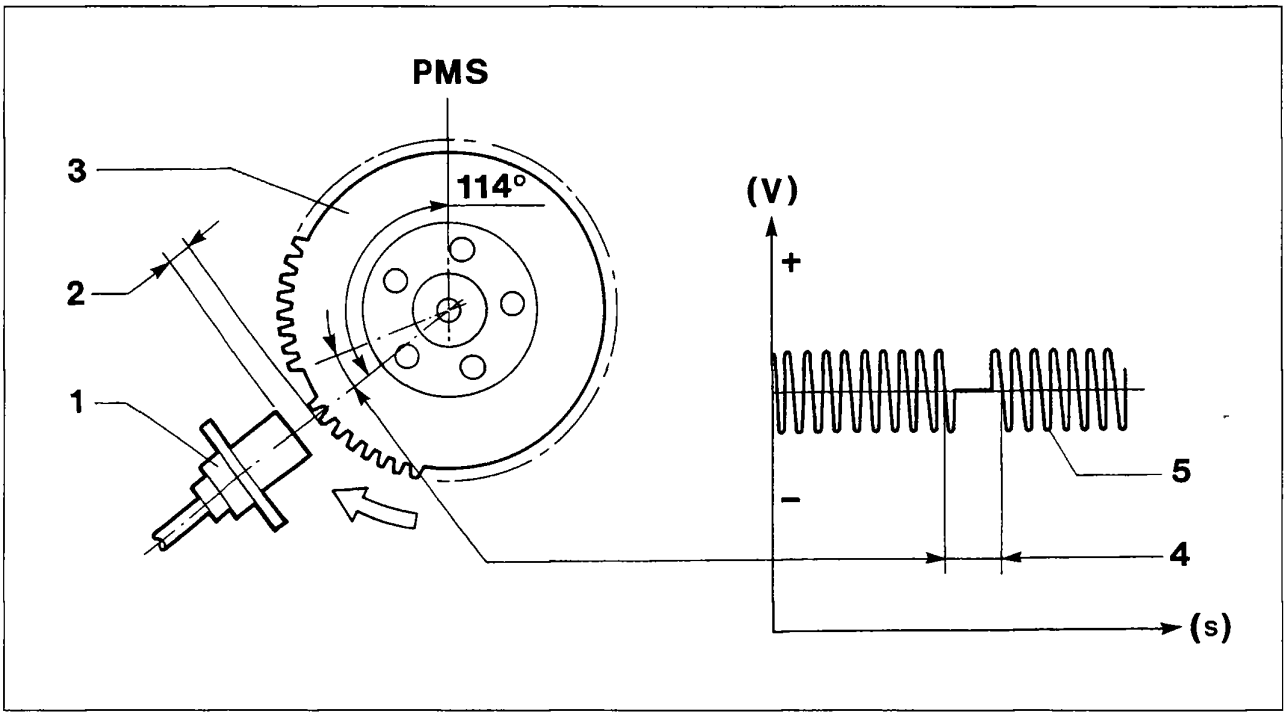
- by interpreting the succession of signals coming from the flywheel sensor, on the crankshaft, the control unit recognizes TDC for the pair of cylinders 1-4.
- using a particular strategy, the control unit is capable, by failing to operate a certain injector, of evaluating the consequent variation in speed (not noticeable by the driver), of recognizing to which cylinder the injector not operated belongs and, consequently, of determining the correct cylinder sequencing (software timing).

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In particular, the signals are made up as follows.
There are sixty teeth on the flywheel, two of which have been removed to create a space: the angle between two consecutive teeth is therefore 6 degrees:
The point of synchronism is recognized at the end of the first tooth following the two missing teeth: the flywheel is fitted so that as this tooth passes the pair of cylinders 1-4 is 17 teeth before TDC.




1. Engine rpm and TDC sensor
2. Gap
3. Flywheel 60-2 teeth
4. Signal corresponding to the two missing teeth
5. Flywheel signal (engine rpm sensor)

## MANAGEMENT OF THE INJECTION

The injection management strategies are designed to provide the engine with the correct quantity of fuel and at the correct time according to the engine operating conditions.

The management of the injection basically consists of calculating the injection time, determining the injection timing and then implementing it by operating the injector.
The "basic" injection time is calculated by means of mathematical interpolation of the speed/load maps: the experimentally obtained values contained in the maps also depend on the specifications of the injector.
The "final" injection time is determined through a calculation algorhythm in which the "basic" time is corrected by a series of coefficients which take into account the different engine operating conditions which are highlighted by the various sensors in the system.



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### Controlling the mixture strength (feed back control)

**NOTE** *The mixture ratio is defined and denoted by the Greek letter α (alfa).*

$$\frac{\text{quantity of air drawn in by the engine}}{\text{quantity of fuel injected}}$$

*This is defined as the stoichiometric ratio and is denoted by α st.*

$$\frac{\text{theoretical quantity of air required to burn all the fuel injected}}{\text{Quantity of fuel injected}}$$

*This is defined as the mixture strength and is denoted by the Greek letter α (Lambda):*

$$\frac{\text{quantity of air drawn in by the engine}}{\text{theoretical quantity of air required to burn all the fuel injected}}$$

It can easily be deduced that $\alpha st = \lambda$ .
The stoichiometric ratio depends on the type of fuel: for current unleaded petrol this value is around 14.7 - 14.8 which corresponds to a Lambda of 1:
A mixture is called rich when the quantity of air is lower than the stoichiometric value and in this case the Lambda $\lambda < 1$:
A mixture is called poor (or lean) when the quantity of air is higher than the stoichiometric value and in this case the Lambda $\lambda > 1$.

The strategy is designed to correctthe "basic" injection times so that the mixture strength continuously fluctuates at a high Hertz frequency:

**NOTE** *1 Hz = 1 oscillation per second*

In the following conditions:
- cut-off,

or

- engine fully laden,

or

- engine cold (coolant and air temperature below about 20 °C)

the strategy is disabled.

### Self-adjustment

The control unit is equipped with a self-adjustment function which has the task of memorizing any differences between the basic map and corrections made by the Lambda sensor which may occur persistently during operation. These differences (due to the ageing of the system and engine components) are permanently memorized allowing the adaptation of the system operation to the gradual alterations in the engine and components compared with when they were new.
The strategy is disabled whilt the charcoal filter solenoid valve is open.
If the control unit is replaced, a road test must be carried out where the engine is allowed to reach operating temperature and the control unit intervenes in the self-adjustment mode (especially during idling stops).

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## Starting and operation when cold

During cold starting the injection is managed simultaneously (full-group), i.e. not phased: this situation persists until a certain coolant temperature is reached (about 0°C), after which the management becomes phased.

The injection time whilst the engine is being driven by the starter motor is determined by a special map according to the temperature of the coolant: when the engine is started up, the calculation returns to the normal speed/load map.

During operation when cold, since there is a natural weakening of the mixture as a result of the reduced evaporation and the strong condensation of the fuel on the internal walls of the inlet manifold, the "basic" injection time is increased by a multiplication coefficient which depends on the temperature and speed of the engine.

## Operation in full load conditions

This strategy is enabled when the butterfly exceeds a certain threshold which depends, in turn, on the engine speed.

The injection time in this situation is determined by a special map which depends on the engine load and speed conditions.

## Operation in acceleration and deceleration conditions

The acceleration or deceleration situation is interpreted by the system as a transition stage between two conditions, departure and arrival: this transition can be positive (acceleration) or negative (deceleration).

The transition management strategy is very complex, having to take a large number of factors into account.

In general, the injection time is increased for positive transitions and reduced for negative ones.

The extent of the correction basically depends on the variation in the engine load: however, the movement speed of the butterfly, the engine speed, the gear engaged (taken from the ratio between the engine speed and the vehicle speed) and the temperature of the engine (coolant and intake air) all have an effect and are interconnected in different ways.

The "basic" injection time is multiplied by a coefficient, in turn the sum of two coefficients: the first takes into account the temperature of the engine and the opening speed of the accelerator butterfly; the second depends on the engine rotation speed.

In particular, if the increase in the injection time is feasible at an injector which has just closed, the control unit reopens the injector (extra pulse) in order to compensate the mixture strength extremely quickly: the subsequent injections are, on the other hand, already increased on the basis of the coefficients mentioned previously.

## Operation in cut-off conditions

The control unit enables the cut-off strategies when the temperature of the engine exceeds a certain level.

The cut-off strategy is implemented when the control unit recognizes that the butterfly is in the minimum position (butterfly potentiometer signal): it is disabled when the engine is cold to prevent driveability problems.

The engine supply is enabled again when the butterfly is no longer closed or when the engine speed goes below a level which depends on the coolant temperature.



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### Rotation speed restricter

This strategy restricts the maximum speed which can be reached by the engine enabling the cut-off. There are two different cut-off levels:

- static restricter (the engine speed approaches the level slowly): maximum speed = 6670 rpm;
- dynamic restricter (the speed approaches the level rapidly): maximum speed = 6500 rpm;

### Electric fuel pump operation

The electric fuel pump is operated by the engine control unit by means of a relay.
The pump cuts out:

- if the engine speed goes below 50 rpm
- after a certain period (about 5 seconds) with the ignition key in the ON position without the engine being started up (timed go ahead);
- if the inertia switch has been operated.

### Operation of the injectors

The operation of the injectors is the phased sequential type. However, during cold starting the injectors are operated in parallel up to a certain temperature.
The phasing of the injectors can vary according to the engine speed.

## MANAGEMENT OF THE FIAT CODE ANT-THEFT FUNCTION

The system is equipped with an anti-theft function. This function is achieved thanks to the presence of a special control unit (FIAT CODE) capable of conversing with the engine control unit and an electronic key, with a special transmitter for sending a recognition code.

Each time the key is turned to the OFF position, the FIAT CODE system completely deactivates the engine control unit.

When the key is turned to the ON position, the following operations take place in the order given:

1. the engine control unit (whose memory contains a secret code) sends the FIAT CODE control unit a request to send the secret code to deactivate the immobilizer function;
2. the FIAT CODE control unit responds by only sending the secret code after having, in turn, received the recognition code transmitted by the ignition key;
3. the recognition of the secret code allows the deactivation of the engine control unit immobilizer function and normal operation is resumed.

**NOTE** *If the FIAT CODE anti-theft system is fitted, DO NOT CARRY OUT the test, during the fault diagnosis, using another engine control unit. In effect, in such circumstances, the FIAT CODE control unit would transfer the (unrecognized) code to the test control unit which could then no longer be used on other vehicles.*

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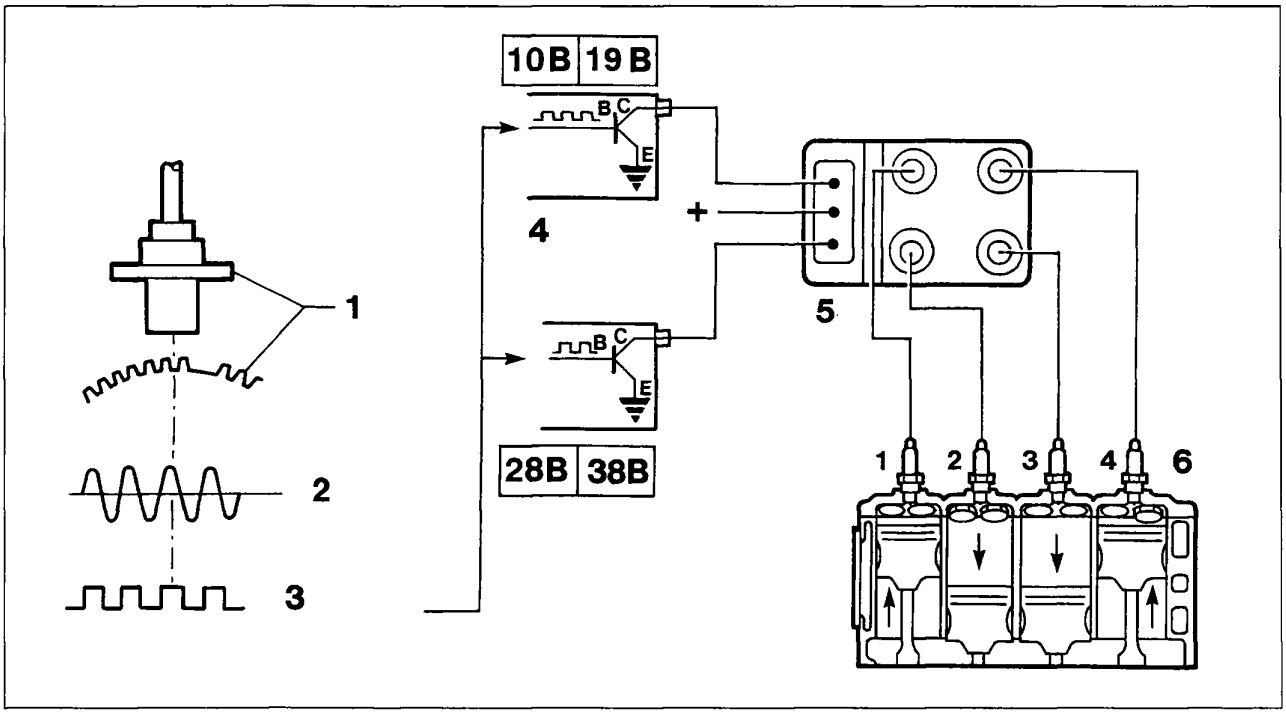
## MANAGEMENT OF THE IGNITION

The management of the ignition mainly consists of determining the desired ignition advance according to the engine operating conditions and implementing it by operating the power transistor, located inside the control unit.
The "basic" advance value, calculated according to the engine load and speed conditions, is then corrected on the basis of the different engine operating conditions.
The primary winding for each coil is supplied by the battery voltage via the relay and is connected to the power transistor manifold incorporated in the engine control unit whose emitter is connected to earth, whilst the base receives the operating voltage from the control unit.

According to the engine rotation speed and the ignition advance to be implemented, the engine control unit establishes the moment for the start of the conduction for the primary winding so that the desired current intensity (saturation) is reached in the primary winding just before this current is cut off.

This moment obviously varies in terms of the angle in relation to TDC for the explosion stroke of each cylinder and the greater the engine rotation speed, the greater the advance, since the time required to saturate the current in the coil primary winding is virtually constant: it is determined using appropriate coefficients stored in the memory during the mapping stage (dwell management).

The moment for the start of conduction is also corrected according to the battery voltage.
The engine control unit therefore determines the moment the current in the primary winding is cut off, transforming the advance degrees into the time needd for the engine to travel through this angle: this time constitutes the advance in relation to TDC for the explosion stroke with which the current at the base of the transistor is interrupted.
The moment at which the current at the base of the power transistor is interrupted, the connection to earth of the primary winding is interrupted and, as a result, the high tension is discharged at the secondary winding.




4F010PJ01

1. Engine rpm and TDC sensor and flywheel
2. Control unit input signal
3. Signal converted in control unit (square wave)
4. Internal power module
5. Coil
6. Spark plugs



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### Starting

During starting, it is not possible to carry out the normal management of the advance because the considerable fluctuations in the rotation speed do not allow the correct calculation of the dwell and the advance. The control unit implements a fixed advance for the entire time the engine is driven by the starter motor.

### Operation at high temperatures

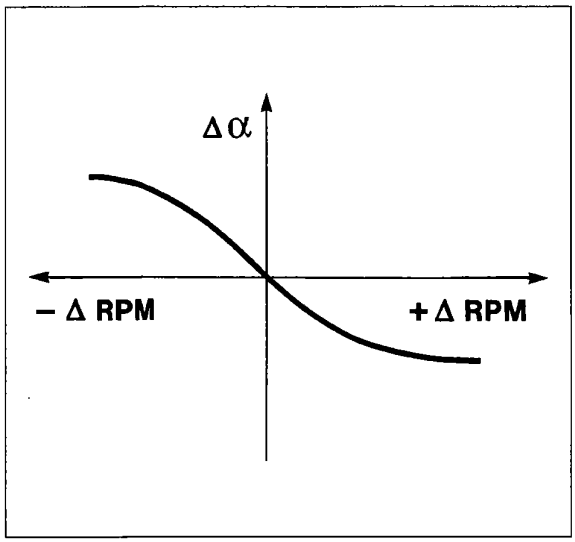
The strategy is enabled when the temperature of the intake air exceeds a certain level.
The "basic" advance value is reduced according to this temperature.

### Operation in cut off conditions

The injection advance is reduced on entry into cut-off conditions: from the moment the fuel supply is restored, the advance is gradually returned to the "basic" value.

### Operation in take-off conditions

This strategy reduces the advance when the vehicle sets off from stationary.




4F011PJ01

Δ α: idle ignition advance correction
+ΔRPM: idle speed above the nominal value
-ΔRPM: idle speed below the nominal value

### Operation with the engine idling

When the engine is idling, the management of the advance is implemented independently of the "basic" advance.

The idle advance is correctly in a manner inversely proportional to the variation in the speed in relation to the pre-set speed, in turn, dependent on the temperature of the coolant.

In particular, the advance is increased if the speed decreases and descreases if the speed increases in order to guarantee the stability of the actual speed.

### Control of the detonation

This strategy has the task of detecting the presence of detonation, by processing the signal coming from the sensor. The strategy continuously compares the signal coming from the sensor with a level which is, in turn, continuously updated to take into account background noise and the ageing of the engine.

If the system recognizes the presence of detonation, the strategy reduces the ignition advance, proceeding in steps of 3° up to a maximum of 9° until the phenomenon has disappeared. Later, the advance is gradually restored to the basic value or until the phenomenon starts again.

The strategy also has a self-adjustment function which memorizes the reductions in the advance which are continuously repeated, adapting the advance to the different conditions in which the engine finds itself (for example, the use of a low octane rating fuel). The strategy is capable of restoring the advance to the value memorized if the conditions which caused the reduction disappear.

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# 10.

## MANAGEMENT OF THE ENGINE IDLE SPEED CONTROL

The general objective of the strategy is to keep the engine speed around the value memorized (engine warm: 800 rpm); the position of the butterfly depends on the engine conditions and speed and the vehicle speed.

- Starting.

When the key is inserted, the butterfly assumes a position which depends on the temperature of the engine and the battery voltage (open loop position).

- Engine running and accelerator pedal released.

The engine speed varies according to the temperature of the engine and is kept constant close to this value by altering the position of the butterfly to compensate for any fluctuations in the speed.
This takes place, in particular, when external loads are applied (power steering, heated rear windscreen, etc.).

If the fans and the air conditioning is switched on, both managed by the control unit and the power assisted steering reaches the end of travel position, signalled by a switch, the strategy manages the butterfly in advance of the load being applied.

- Normal driving.

Under these circumstances the actuator is in the open loop position.

- Deceleration.

In release conditions outside of idling, the control unit controls the position of the butterfly through a particular flow rate curve (dash-pot curve), i.e. it slows down the return of the butterfly to the closed position thereby producing a reduction in the braking effect of the engine.

In addition, if the vehicle is decelerating, the information concerning its speed, correlated to that of the engine speed, allows the optimum management of the dash-pot effect adapting it to the gear engaged.

## MANAGEMENT OF THE ACTIVE CHARCOAL FILTER

This strategy controls the position of the charcoal solenoid valve in the following way:

- during starting the solenoid valve remains closed, preventing the fuel vapours from enriching the mixture;

- after cold starting, the solenoid valve remains closed for the entire time the engine is warming up;

- with the engine warm, the control unit operates the solenoid valve in duty-cycle to control the quantity of fuel vapours sent to the inlet (scavenging of the charcoal filter) according to the engine speed and load. In particular, the system alternates periods of scavenging with periods free from scavenging: during the latter, the self-adjustment strategy, which is disabled during the scavenging, finds itself enabled;

the solenoid valve remains closed in cut-off conditions.



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## MANAGEMENT OF THE CLIMATE CONTROL SYSTEM

The injection/ignition control unit is functionally connected to the climate control system, as follows:

1. it receives the request to switch on the compressor and operates the various interventions (additional air);

2. it gives the go ahead to switch on the compressor when the strategy conditions are verified;

3. it receives information on the state of the four stage pressure switch and operates the various interventions (operation of the radiator fan).

As far as point 1 is concerned, if the engine is idling, the control unit increases the air flow rate, altering the position of the butterfly in advance of the compressor being switched on and conversely returns the butterfly to its normal position after the compressor is switched off.
The engine idle speed is also increased for the entire time the compressor is activated (engine warm: 900 rpm).

As far as point 2 is concerned, the control unit automatically controls the switching off of the compressor:

- for several seconds (timed disengagement):
  - in high engine power requirement conditions (fierce acceleration);
  - during vehicle take-off;

- as long as the following critical conditions exist:
  - temperature of the engine coolant above a pre-set level (engine overheated);
  - engine speed below 700 rpm

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# 10.

## MANAGEMENT OF THE RADIATOR FAN

**NOTE** *Since the temperature of the coolant is measured by the sensor there is no longer a thermal contact on the radiator.*

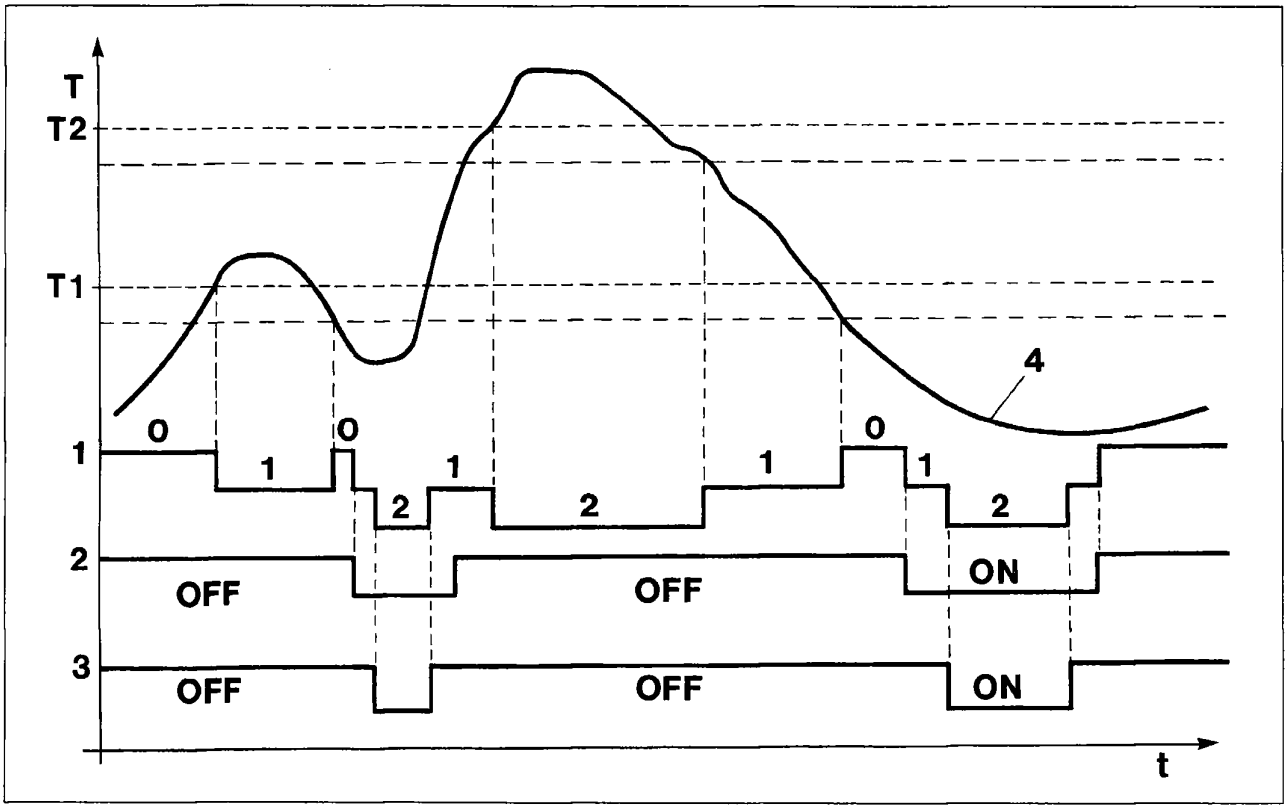
The engine control unit controls the engagement of the radiator fan according to the temperature of the coolant and whether or not there is a climate control system.

In the case of versions with climate control, there are two fan operating speeds, managed according to two different, completely independent logics.
- According to the temperature of the coolant.

Low speed: it comes on when the temperature of the coolant reaches T 1 = 96.5 °C;
High speed: it comes on when the temperature of the coolant reaches T 2 = 102 °C.

It switches off with a hysteresis of around 3 °C.
- According to the four stage pressure switch condition.

Low speed: it switches on when level II of the pressure switch is engaged;
High speed: it switches on when level III of the pressure switch is engaged.




4F014PJ01

T 1 = 96.5 °C
T 2 = 102 °C

ON: pressure switch activated

OFF: pressure switch deactivated

1. Solenoid valve status
   0 = off
   1 = low speed
   2 = high speed
2. level II of four stage pressure switch
3. level III of four stage pressure switch
4. Progress of engine coolant temperature



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## DIAGNOSTICS

The system is equipped with an autodiagnostic function which is designed to check for irregularities with the following components:

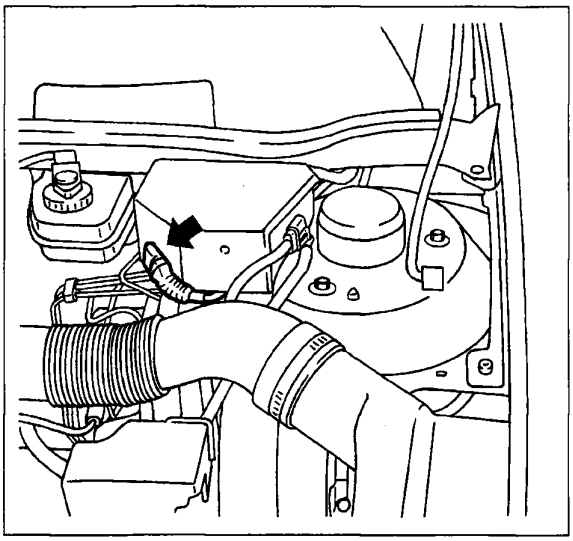
### Actuators

injectors
coils
charcoal filter soleniod valve
engine idle adjustment actuator
electric fuel pump relay
climate control relays (if fitted)

### Sensors

engine speed sensor
vehicle speed sensor
Lambda sensor
butterfly position sensor
coolant temperature sensor
detonation sensor

### Location of diagnostic connector



4F015PJ01

The detection of a fault, if confirmed, involves it being permanently memorized, in addition to the exclusion of the sensor from the system until it is restored.

The detection of a confirmed fault usually involves: the warning light in the dashboard coming on: the light goes out when the fault conditions disappear.

**NOTE** *During starting, the bulb:*
- *comes on for about 4 seconds;*
- *goes out for 0.1 secnods;*
- *remains on/off definitively according to whether or not there are "permanent" errors.*

When working with the diagnostic equipment it is possible to carry out the complete fault diagnosis of the system, which consists of three stages:

- display of a series of functional parameters (with the engine switched off or running);

- display of the errors and their cancellation;

- activation of some actuators (active diagnosis).

### Recovery strategy

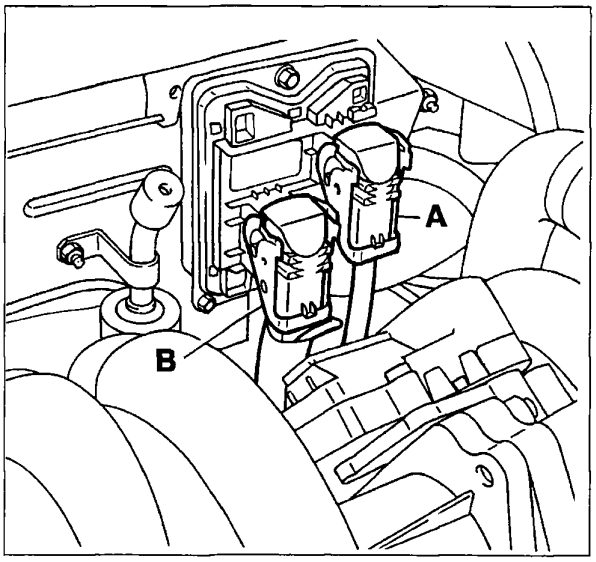
If a fault is detected with the sensors/actuators, the control unit, where possible, replaces the missing data, reconstructing it using software (recovery) to allow the operation of the engine.



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# 10.

## ELECTRICAL/ELECTRONIC CIRCUIT




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### Wiring

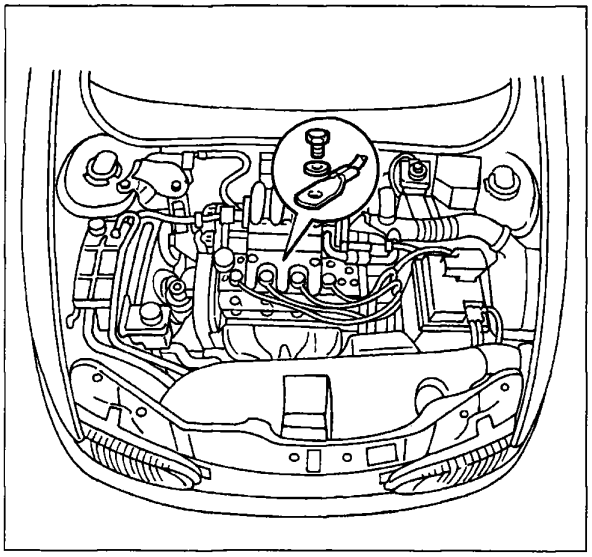
The system has two distinct sets of wiring for the control unit connectors: the engine side wiring (B) connects the components fitted on the engine to the engine control unit, the vehicle side wiring (A), on the other hand, connects the other components to the control unit and constitutes the interface with the vehicle wiring.

*vehicle side wiring (A)*

supply from battery
supply from ignition switch
fuses
system relay feeds
radiator fan relay(s)
climate control compressor relay (if fitted)
CODE control unit connection
on board panel connection
diagnostic equipment

*engine side wiring (B)*

engine rpm sensor
absolute pressure and air temperature sensor
coolant temperature sensor
detonation sensor
Lambda sensor
power assisted steering end of travel sensor
injectors
idle speed actuator/butterfly position sensor
ignition coil
charcoal filter solenoid valve



4F016PJ02

### Layout of system earth points

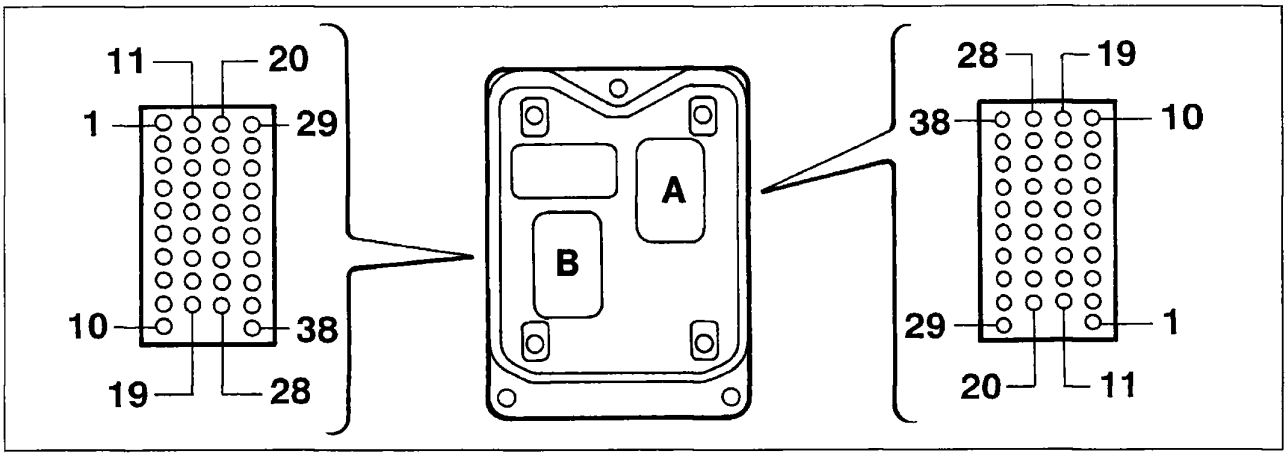
In order to improve the electro-magnet compatibility and functional reliability, special care has been taken over the number and location of the earth points, as illustrated in the diagram below:

- main earth directly on battery negative;
- engine control system earth on cylinder block/crankcase near the detonation sensor.



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## BOSCH M1.5.5 SYSTEM CONTROL UNIT PIN OUT




4F017PJ01

### Connector B (engine side)

1. Sensors earth
2. Detonation sensor signal
3. Intake air temperature sensor signal
4. Butterfly position senor signal
5. Coolant temperature sensor signal
6. Operation of injector for cylinder 1
7. Operatin of injector for cylinder 4
8. Lamba sensor heater operation
9. N.c.
10. Operation of coil for cylinder 2-3
11. Detonation sensor earth
12. Absolute pressure sensor signal
13. Butterfly position sensor signal
14. N.c.
15. N.c.
16. Operation of injector for cylinder 3
17. Operation of injector for cylinder 2
18. N.c.
19. Operation of coil for cylinders 2-3
20. N.c.
21. Lambda sensor earth
22. Engine rpm sensor positive
23. N.c.
24. N.c.
25. N.c.
26. Idle speed actuator operation
27. N.c.
28. Operation of coil for cylinders 1-4
29. Sensors supply
30. Lambda sensor signal
31. N.c.
32. Engine rpm sensor negative
33. N.c.
34. Operation of charcoal filter solenoid valve
35. Operation of idle speed actuator
36. N.c.
37. N.c.
38. Operation of coil for cylinders 1-4

### Connector A (vehicle side)

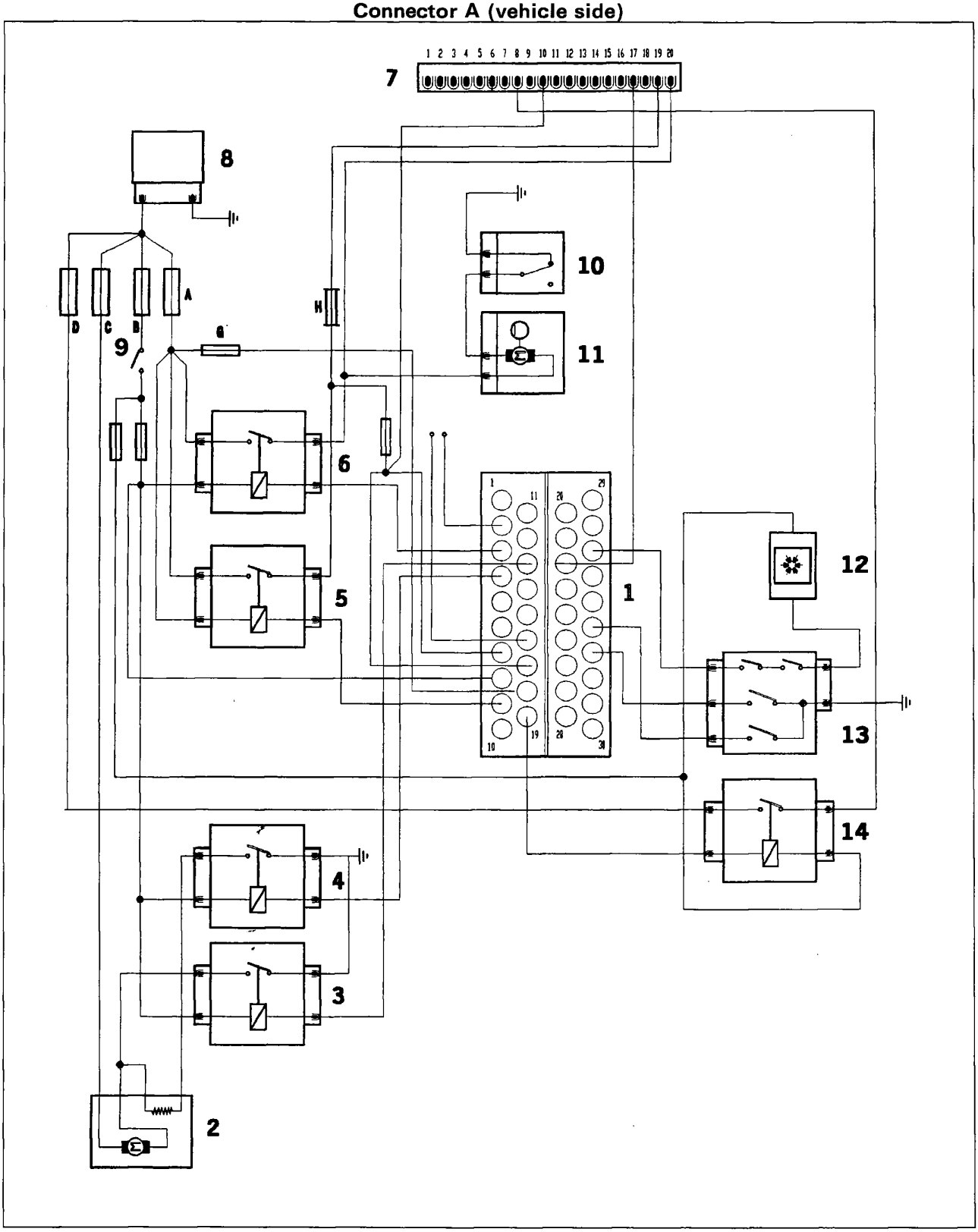
1. N.C
2. Operation of rev counter
3. Operation of fuel pump relay
4. Operation of high speed fan relay
5. N.c.
6. N.c.
7. Control unit supply from relay (+30)
8. Engine started signal (from ignition switch)
9. Engine control system relay feed
10. N.c.
11. Line K
12. Operation of system failure light
13. Operation of low fan speed relay
14. N.c.
15. N.c.
16. CODE connection
17. Control unit supply from relay (+30)
18. Control unit supply (+30)
19. Operation of compressor relay (if fitted)
20. N.c.
21. N.c.
22. Power assisted steering sensor signal
23. N.c.
24. N.c.
25. N.c.
26. N.c.
27. Vehicle speed sensor signal
28. N.c.
29. N.c.
30. N.c.
31. Compressor engagement operation
32. N.c.
33. N.c.
34. Four stage thermostat signal (if fitted)
35. Four stage thermostat signal (if fitted)
36. N.c.
37. N.c.
38. N.c.

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# 10.

## BOSCH M1.5.5 SYSTEM WIRING DIAGRAM
Connector A (vehicle side)






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Bosch M1.5.5 system wiring diagram key
Connector A (vehicle side)

1. Control unit
2. Radiator fan
3. Fan high speed relay
4. Fan low speed relay
5. Engine control system relay
6. Fuel pump relay
7. Front cable connection
8. Battery
9. Ignition switch
10. Inertia switch
11. Electric fuel pump
12. Air conditioning control unit (on button)
13. Four stage pressure switch
14. Compressor relay

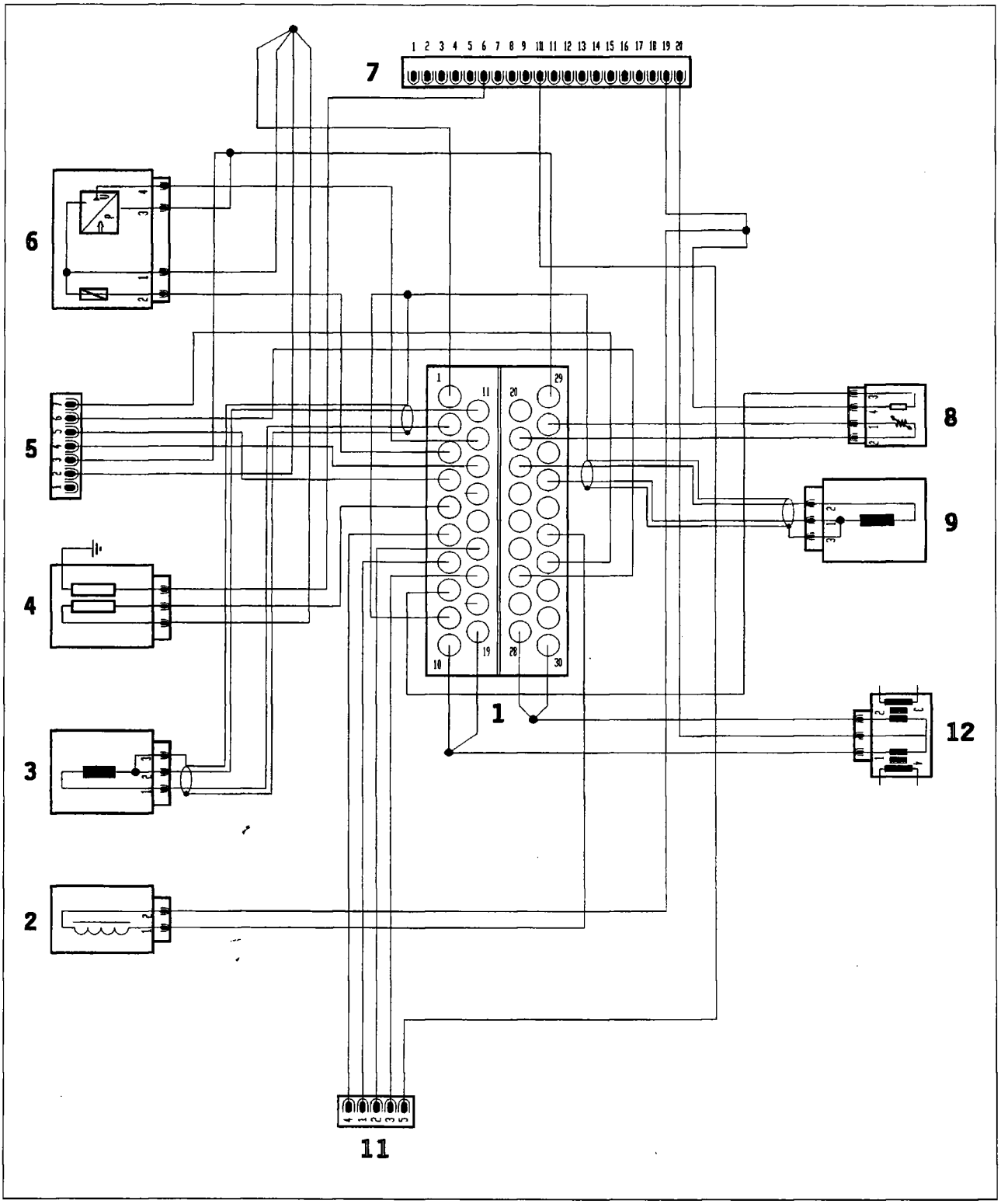
A. 30A fuse
B. 40A fuse
C. 40A fuse
D. 7.5A fuse
E. 7.5A fuse
F. 7.5A fuse
G. 7.5A fuse
H. 15A fuse
L. 15A fuse

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# 10.

## BOSCH M1.5.5 SYSTEM WIRING DIAGRAM
### Connector B (engine side)




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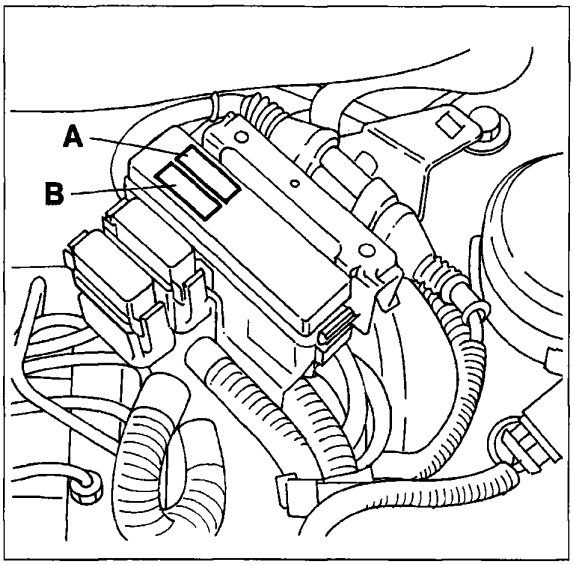
### Bosch M1.5.5 system wiring diagram key
### Connector B (engine side)

1. Control unit
2. Active charcoal filter solenoid valve
3. Detonation sensor
4. Coolant temperature sensor
5. Engine idle adjustment actuator/butterfly position sensor
6. Absolute pressure and air temperature sensor
7. Front cable connection
8. Lambda sensor
9. Engine rpm sensor
10. Coil
11. Injector section

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# 10.




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## LOCATION OF FUSES AND RELAYS

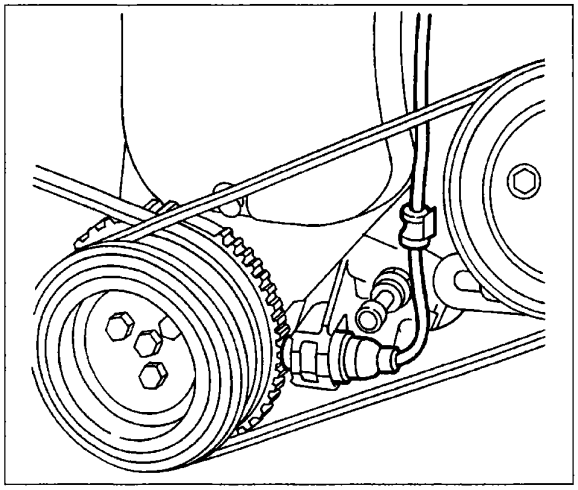
**NOTE** *For more information, see Group 55-Electrical equipment*

### Main fuses (maxi-fuse)

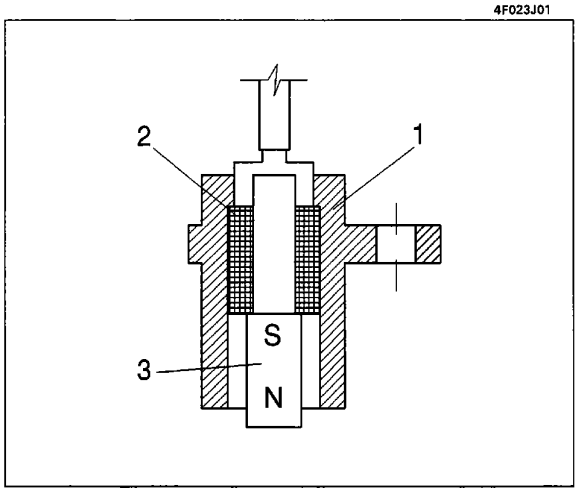
A. System fuse
B. Ignition switch fuse



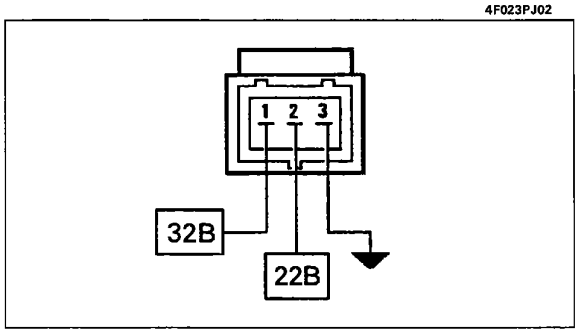
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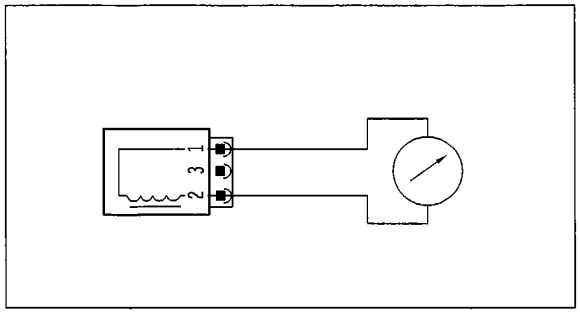
4F023J01




4F023PJ02




4F023PJ03




4F023PJ04

## ENGINE RPM AND TDC SENSOR

The engine rpm and TDC sensor (1) is fixed on the cylinder block/crankcase and is facing the flywheel on the crankshaft pulley.

### Operating principle

The sensor consists of a tubular casing (1) which contains a permanent magnet (3) and an electrical winding (2). The magnetic flow produced by the magnet (3) undergoes fluctuations as a result of the alteration in the gap as the flywheel teeth pass.

These fluctuations produce an electro-motive force in the winding (2) where an alternately positive (tooth facing the sensor) and negative (gap facing the sensor) voltage is produced. The peak sensor output voltage depends, all things being equal, on the distance between the sensor and the tooth (gap).

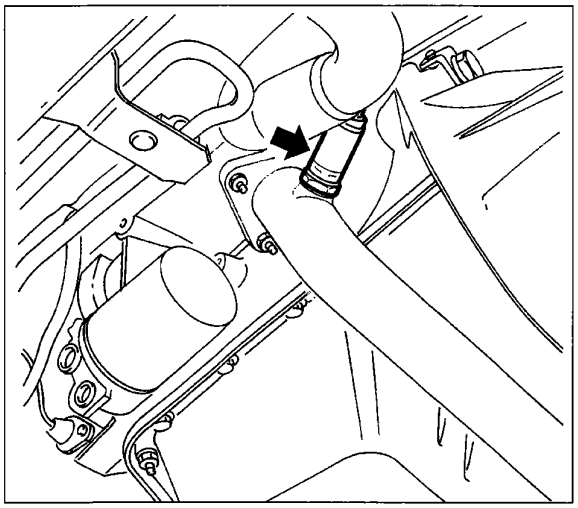
### Wiring connector

The sensor resistance can be measured by disconnecting the connector and connecting an ohmmeter to the sensor

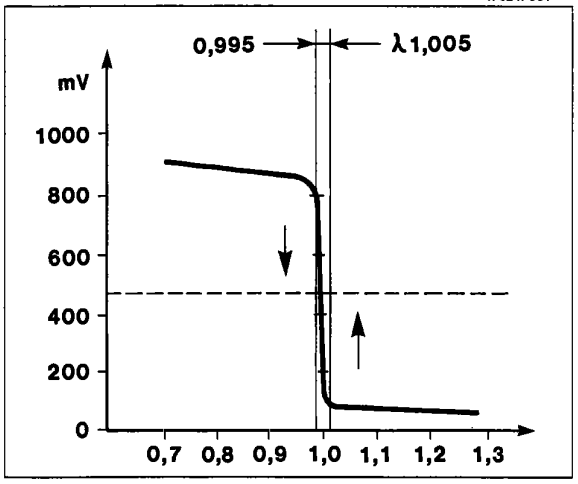
Resistance: **9600+10%** ohm at 20°C



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4F024PJ01




4F024PJ02

λ=1 ideal mixture (stoichiometric)
λ 1 Lean mixture

Excess air; the CO values tend to be low
λ 1 Rich mixture

Lack of air; the CO values tend to be high

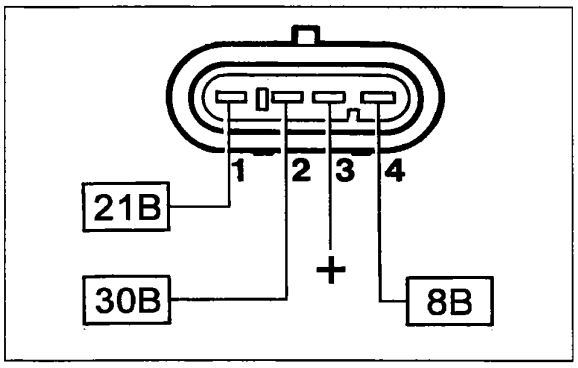
## LAMBDA SENSOR

The Lambda sensor measures the oxygen content of the exhaust gases: it is fitted on the exhaust pipe upstream of the catalytic silencer.
The sensor output signal is sent to the control unit for feed back correction of the mixture strength.
When the sensor provides a low signal (voltage below 200 mV) the control unit recognizes a weak mixture and increases the injection time; later, when the sensor signal is high (voltage above 800 mV), the control unit recognizes a rich mixture and decreases the injection time.
This sequence of interventions is repeated with a frequency in the order of tens of Hertz so that the engine operates with a mixture strength constantly fluctuating around the stoichiometric ratio.
At temperatures below 300 °C the ceramic material is not activated, therefore the sensor does not send reliable signals: to ensure rapid heating during starting and maintain its temperature during idling, the sensor is equipped with a heater with the electrical resistance on permanently.

*The sensor can be rapidly put out of action by the presence of even slight amounts of lead in the fuel.*

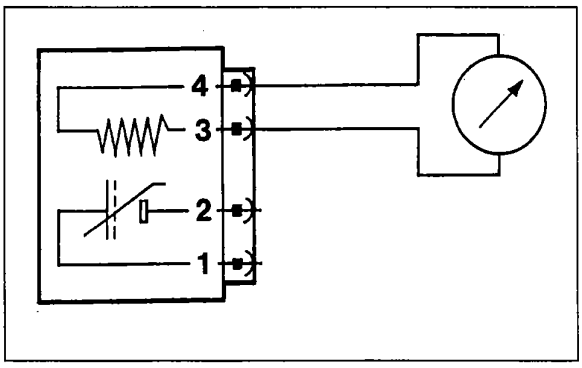
The sensor heating resistance can be measured by disconnecting the connector and connecting an ohmmeter as illustrated in the figure.

Connector wiring




4F023PJ03

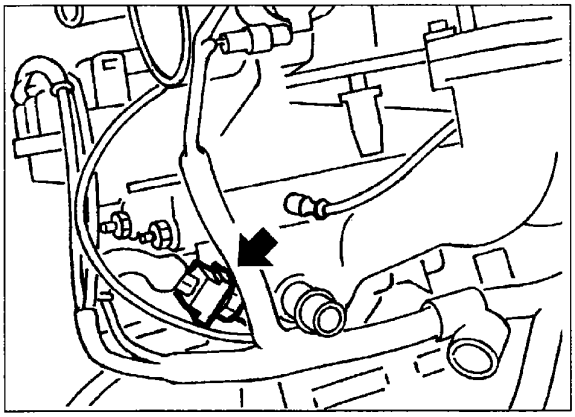
Resistance: 4.5+0.5 ohm at 20 °C




4F023PJ04



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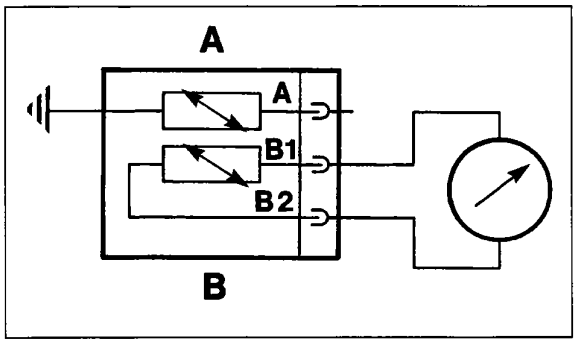


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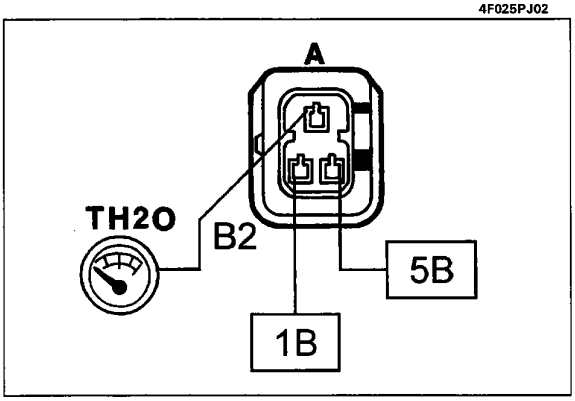
## INJECTION NTC

| °C | M |
|---|---|
| -20 | 16900-15000 |
| -10 | 10100-9100 |
| 0 | 6300-5700 |
| 10 | 4000-3600 |
| 20 | 2600-2400 |
| 25 | 2100-1950 |
| 30 | 1750-1600 |

| °C | M |
|---|---|
| 40 | 1200-1100 |
| 50 | 830-780 |
| 60 | 590-560 |
| 70 | 430-400 |
| 80 | 315-300 |
| 90 | 235-225 |
| 100 | 137-133 |




4F025PJ02




4F025PJ03

## ENGINE COOLANT TEMPERATURE SENSOR

This sensor is fitted on the thermostat.
It is made up of a brass casing which affords protection to the actual resistive elements, consisting of two **NTC** (Negative Temperature Coefficient) thermistors whose electrical resistance decreases as the temperature increases.
The two thermistors are distinct and provide information concerning the temperature to the instrument in the panel (**A**) and to the engine control unit (B).

The reference voltage for the latter is 5 Volt: since the intake circuit in the control unit is designed as a voltage divider, the reference voltage is divided between a resistance in the control unit and the actual sensor.
As a result, the control unit is capable of evaluating the variations in the sensor resistance through the changes in voltage, thereby obtaining temperature information

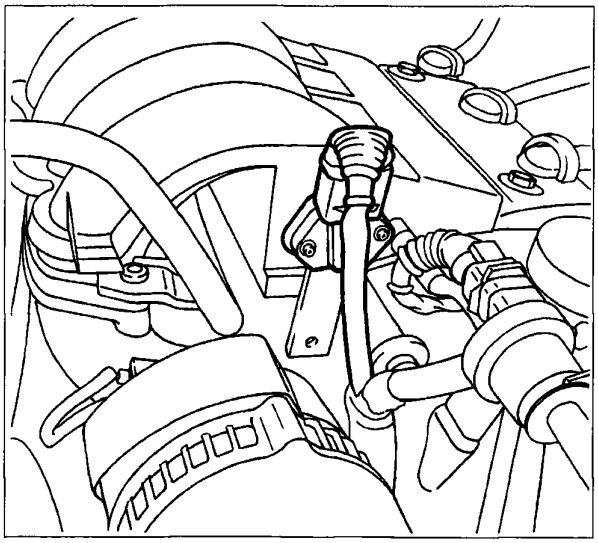
The table illustrates the sensor specifications which can be measured by disconnecting the connector and connecting an ohmmeter as illustrated.

**Connector wiring**

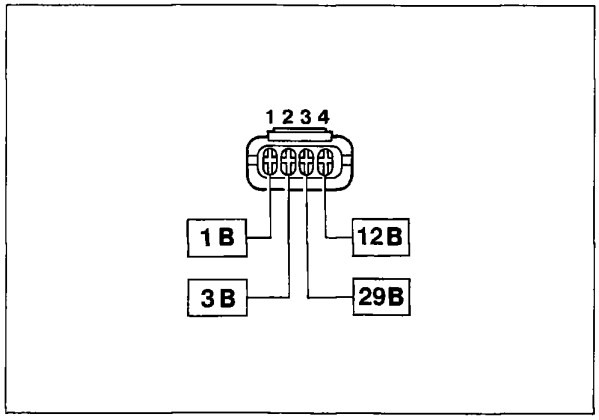


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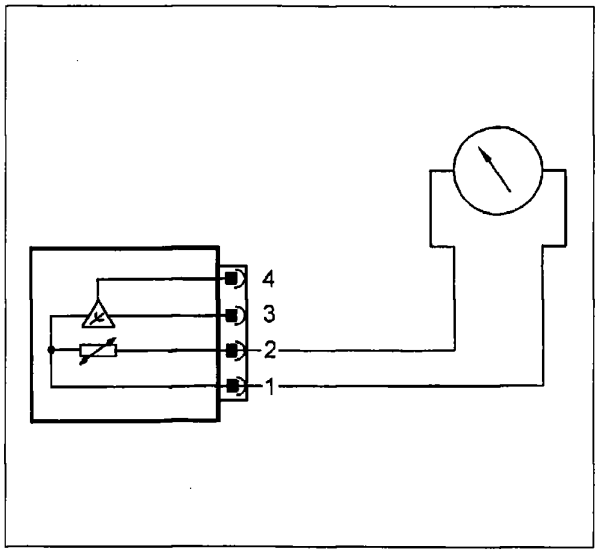
# 10.



4F026PJ01




4F026PJ02




4F026PJ03

## INTAKE AIR TEMPERATURE AND PRESSURE SENSOR

The intake air temperature and pressure sensor is an integrated component which has the task of measuring the pressure and the temperature of the air inside the inlet manifold. Both pieces of information are used by the injection control unit in defining the quantity of air drawn in by the engine; this information is then used for calculating the injection time and the point of ignition. The sensor is fitted on the inlet manifold.

| Temperature (°C) | Resistance (M) |
|---|---|
| -40 | 52600-38700 |
| -20 | 17500-13500 |
| 0 | 6500-5300 |
| 10 | 4200-3400 |
| 20 | 2700-2300 |
| 30 | 1850-1550 |
| 40 | 1300-1050 |
| 50 | 920-750 |
| 60 | 650-530 |
| 80 | 360-290 |
| 100 | 210-160 |

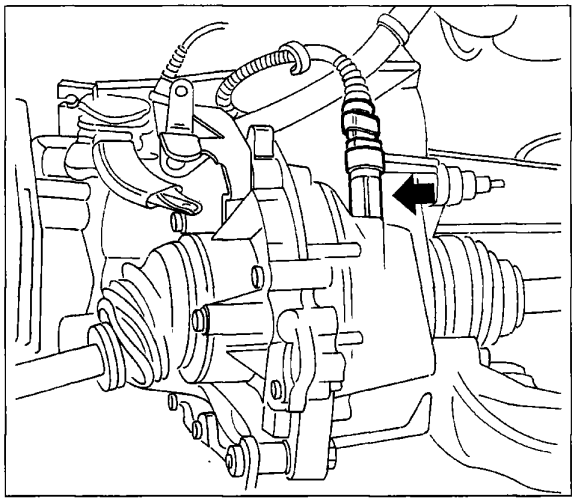
### Connector wiring

### Checking resistance

The table at the side contains the resistance values which the temperature sensor (NTC type thermistor) can assume according to the temperature. These values can be measured by connecting an ohmmeter as illustrated in the diagram.



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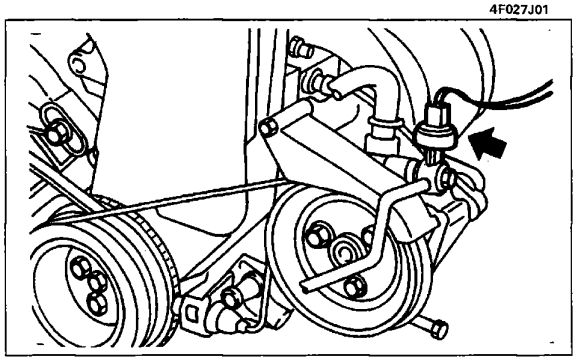


4F027J01

## VEHICLE SPEED SENSOR

This sensor is positioned at the differential output, by the left driveshaft coupling and transmits information concerning the vehicle speed to the speedometer: the signal is then sent to the engine control unit.

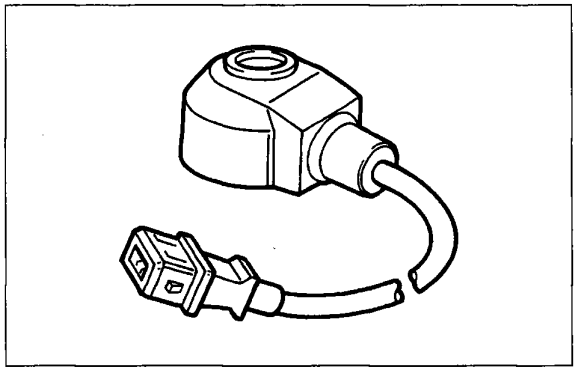
The sensor is the Hall effect type and is calibrated so that a given distance corresponds to each impulse: it is therefore possible to calculate the vehicle speed according to the frequency of the impulses.



4F023PJ02

## POWER ASSISTED STEERING SENSOR

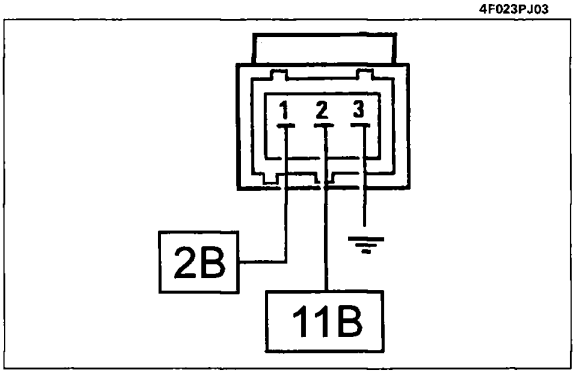
This sensor, fitted on the pump high pressure outlet pipe, consists of a pressure switch which closes when the hydraulic pressure exceeds a level corresponding to the steering close to the end of travel position: the information is used to manage the idle speed control actuator in advance of the absorption of power due to steering.



4F023PJ03

## DETONATION SENSOR

This is a piezoelectric type sensor fitted on the cylinder block/crankcase, symmetrical in relation to the pairs of cylinders 1-2 and 3-4.
This position is determined by the need to detect the onset of detonation in the same way in all cylinders.
When the engine is knocking, cylinder block/crankcase vibrations of a particular frequency are produced and they are transformed by the sensor into a voltage signal proportional to their intensity.



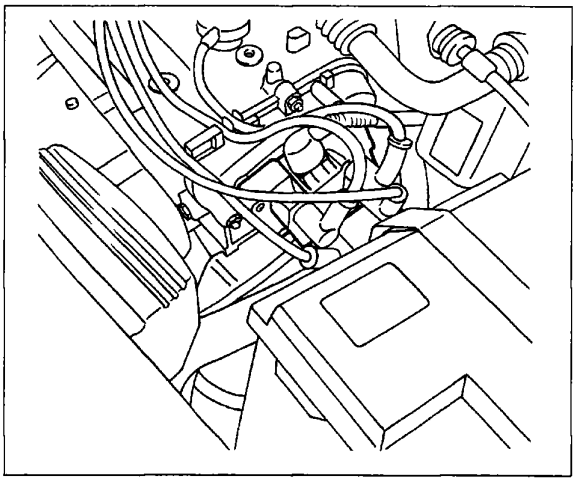

4F023PJ04

Connector wiring

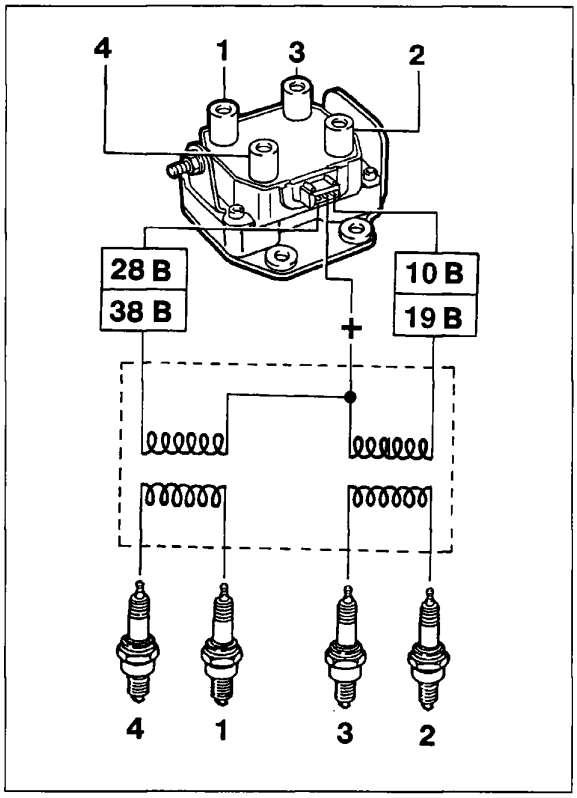


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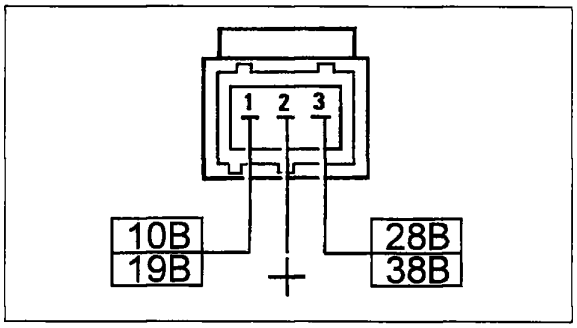
# 10.



4F028PJ01




4F028PJ02




4F028PJ03

## IGNITION COILS

The ignition circuit is the inductive discharge static advance type, where the high tension is supplied by two twin outlet coils fitted laterally to the cylinder head.

The coils used are the closed magnetic circuit type, with windings in a plastic container immersed in epoxide resin. Each coil is connected to the two spark plugs by means of high tension leads with high dielectric properties.

In this type of coil the current in the secondary winding (discharge current) always has the same polarity: therefore one terminal of the circuit is positive and the other negative.

This fact implies that the discharge current in the secondary winding is always flowing in the same direction and therefore the sparks for the two cylinders connected to the coil strike in the opposite way:

- in the spark plug with the positive centre electrode, the spark strikes from the earth electrode to the centre one;
- in the spark plug with the negative centre electrode, the spark strikes from the centre electrode to the earth one;

As a result, the wear of the electrodes between the two spark plugs is different.

Since the intensity of the spark depends on the resistance between the electrodes (dielectric), whilst the spark in the cylinder in the cross-over stage is weak (lost spark) on account of the almost atmospheric pressure in the chamber, the spark in the cylinder at the end of the compression stroke is intense (working spark) on account of the high pressure in the chamber.

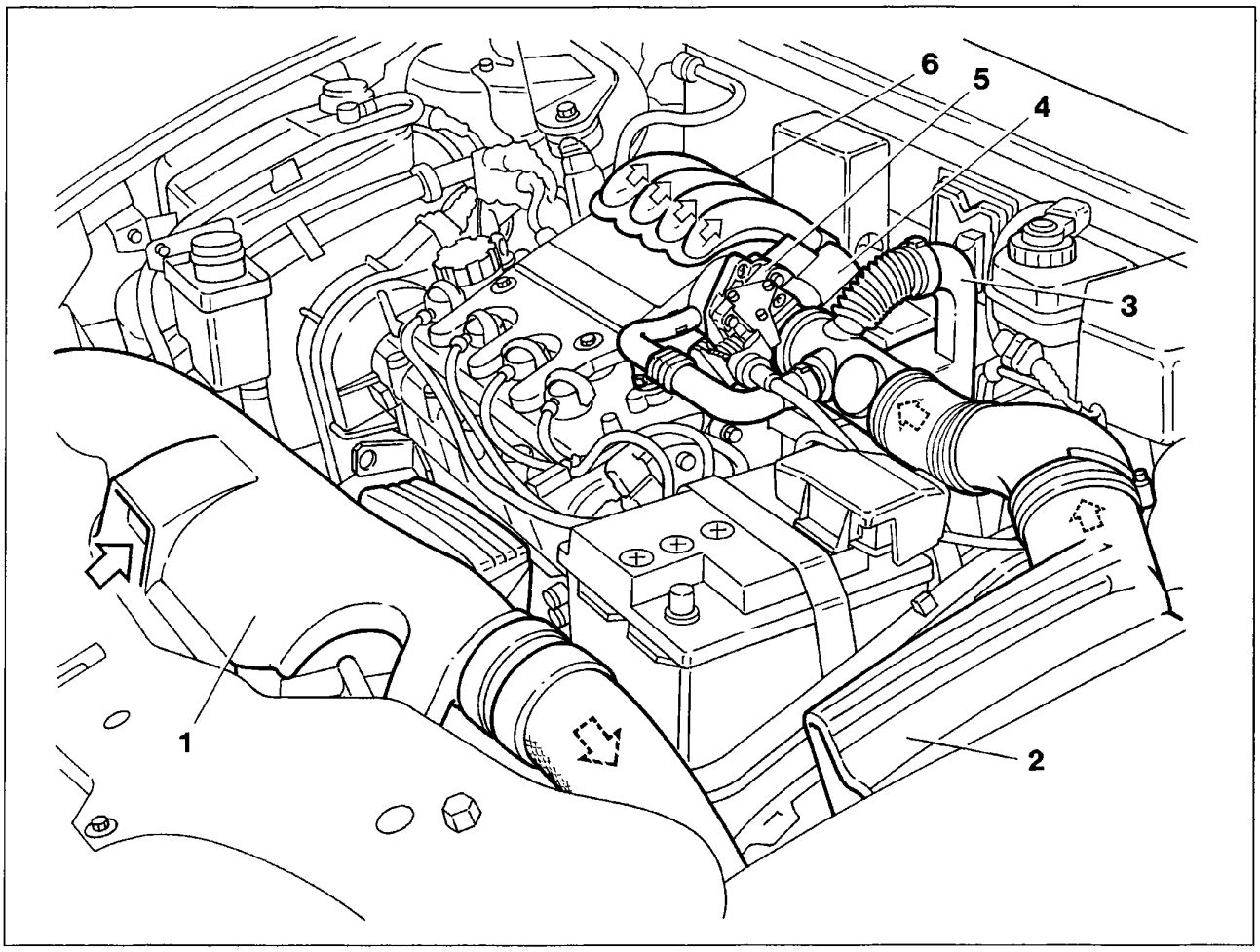
Connector wiring



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## INTAKE CIRCUIT

This consists of various components which ensure the air flow rate required by the engine in the various operating conditions.



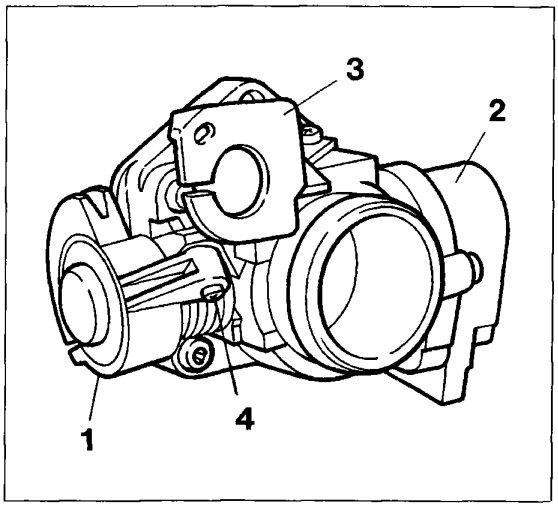

4F029PJ01

1. Intake vent
2. Air filter
3. Resonator
4. Engine idle speed adjustment actuator and butterfly position sensor
5. Butterfly casing
6. Inlet manifold



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# 10.




4F030PJ01

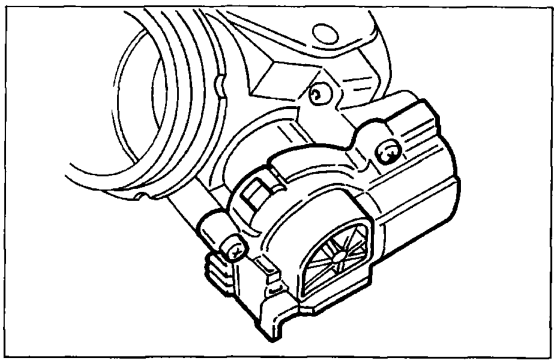
1. accelerator control lever
2. idle speed adjustment actuator and butterfly position sensor
3. accelerator cable adjustment bracket
4. anti-tamper screw

## BUTTERFLY CASING

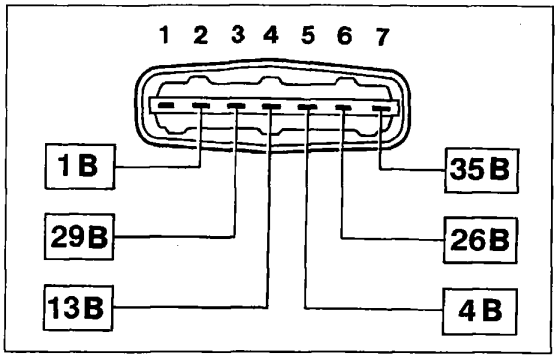
The butterfly casing has the task of metering the quantity of air drawn in by the engine (and therefore the power developed) according to the driver's request via the accelerator.

The butterfly casing is fixed to the inlet manifold: the butterfly is opened via a lever through a gradual opening law (small butterfly opening angles for a large part of the accelerator pedal stroke and large angles in the last part of the stroke).

With the pedal completely released (engine decelerating or idling) the position of the butterfly is regulated by the engine idle adjustment actuator in order to be able to supply the additional air required according to the engine conditions. The actuator also includes the butterfly position sensor.



4F030PJ02




4F030PJ03

## ENGINE IDLE SPEED ADJUSTMENT ACTUATOR AND BUTTERFLY POSITION SENSOR

The actuator, fitted on the butterfly casing, consists of a direct current motor operated by a circuit inside the engine control unit which regulates the position of the butterfly: it has the task of ensuring the additional air for the engine with the accelerator pedal released, in all conditions where this is necessary (idling, deceleration, external loads applied).

The maximum angular opening which can be achieved by the actuator is around 30°.

- the first track goes from the closed position up to 30° and is used for the operation of the butterfly with the accelerator pedal released;
- the second track goes from the closed position up to the maximum butterfly opening and is used for the normal management of the engine.

### Connector wiring



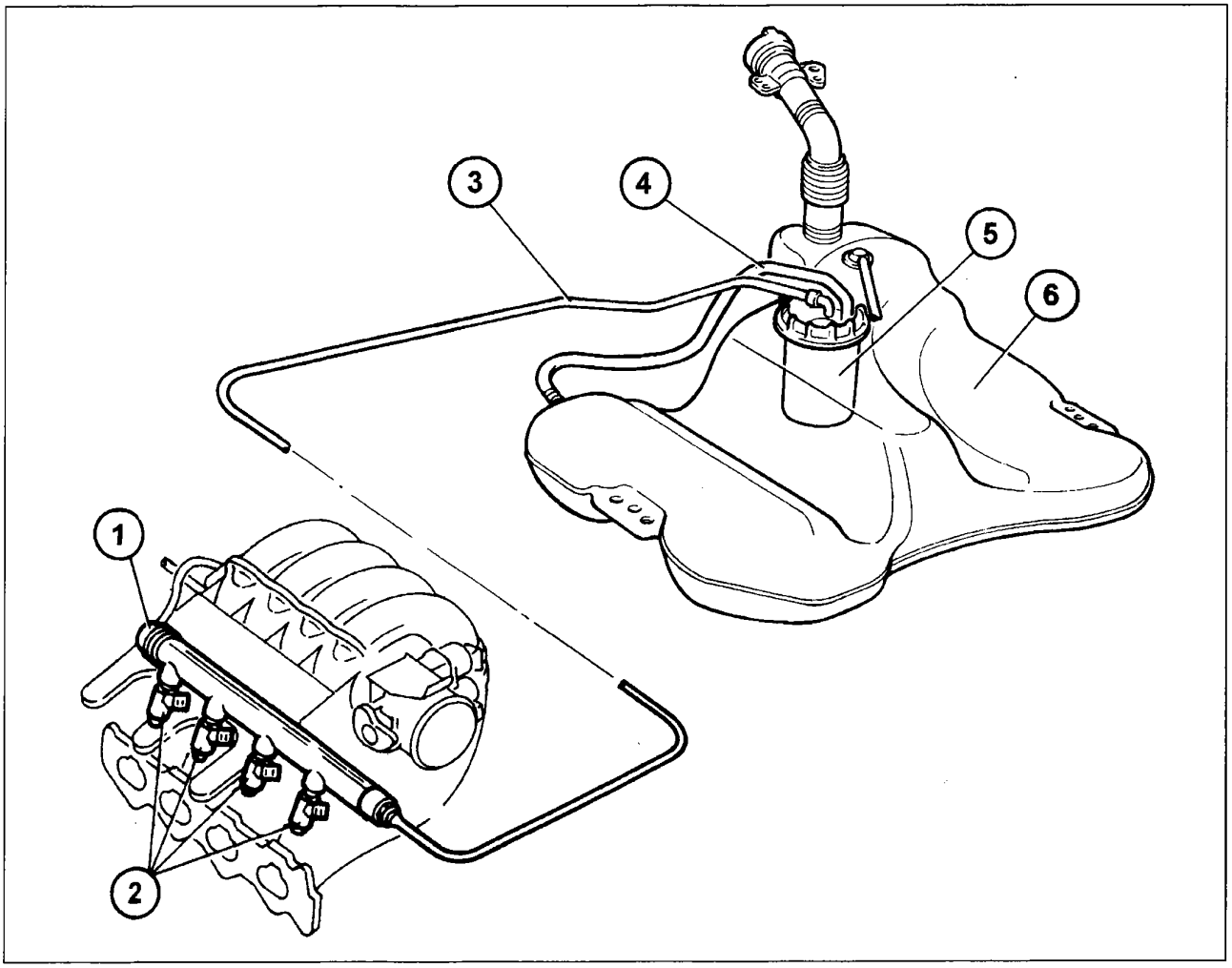
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## FUEL SUPPLY CIRCUIT

This circuit consists of the following components:

- Fuel tank
- Drip tray complete with pump, filter, pressure regulator and gauge
- Supply pipe
- Returnless type fuel manifold complete with injectors

## FUEL CIRCUIT DIAGRAM



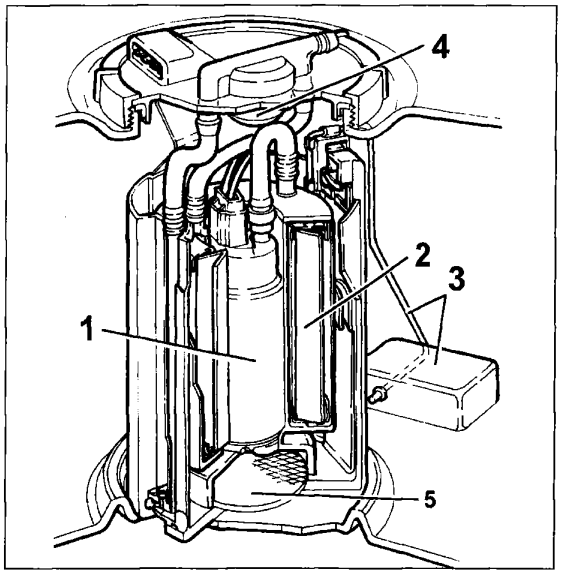

4F031PJ01

1. Air bleed connector
2. Injector manifold
3. Supply pipe
4. Tank filler pipe
5. Drip tray complete with pump, filter, pressure regulator and gauge
6. Fuel tank



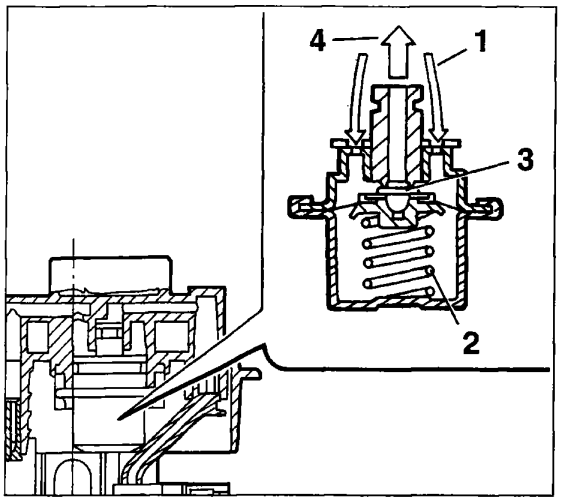
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# 10.




4F032PJ01

1. Electric fuel pump
2. Fuel filter
3. Gauge with float
4. Pressure regulator
5. Gauze pre-filter




4F032PJ02

## FUEL DRIP TRAY ASSEMBLY

### Electric fuel pump

The pump is housed inside the fuel tank on a special drip tray which also supports the gauge and is equipped with a filter on the pump inlet. The pressure regulator is also fitted on the pump supply.
The pump is the single stage peripheral flow type and is designed to run on unleaded fuel.
- The rotor is driven by a direct current electric motor supplied by a relay, operated by the control unit to ensure:
- that the pump cuts out if the engine speed goes below a minimum level;
- the timed operation (about 5 seconds) each time the ignition is switched ON, even if the engine is not started up;
- operation when the engine is started up.

The pump is equipped with an excess pressure valve which short circuits the supply with the inlet if the pressure in the supply circuit exceeds about 5 bar, to prevent the electric motor from overheating.

In addition, a single-acting valve, fitted on the supply, prevents the entire fuel circuit from draining when the pump is not working.

### Fuel filter

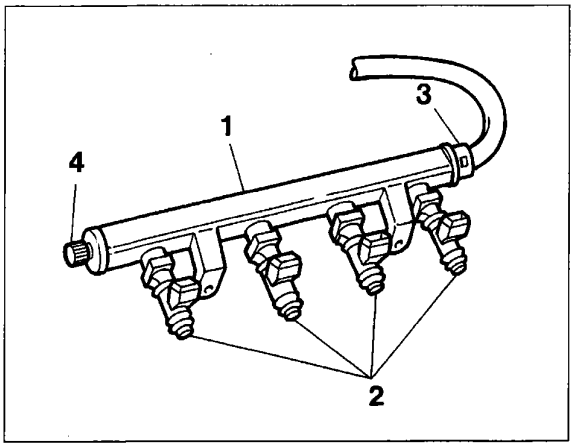
The fuel filter is housed in the casing surrounding the pump and does not need to be replaced periodically.

### Fuel pressure regulaor

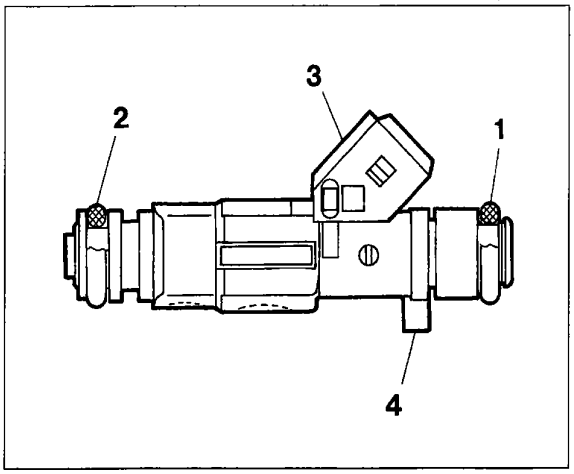
This is a differential diaphragm device, adjusted during manufacture, to a pressure of 3.50±0.05 bar and it is located in the top part of the drip tray.
The fuel under pressure (1), coming from the pump, exerts a force on the flow valve (3) opposed by the calibrated spring (2). When the calibration pressure is exceeded, the flow valve opens and the excess fuel (4) returns to the tank, thereby stabilizing the pressure in the circuit.



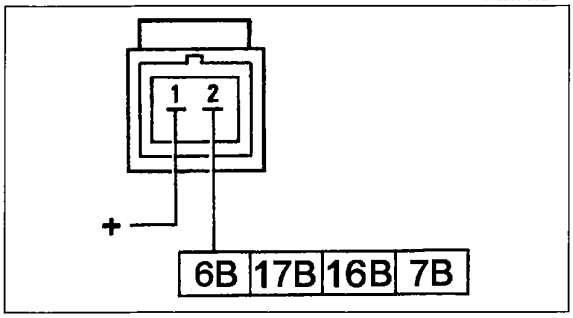
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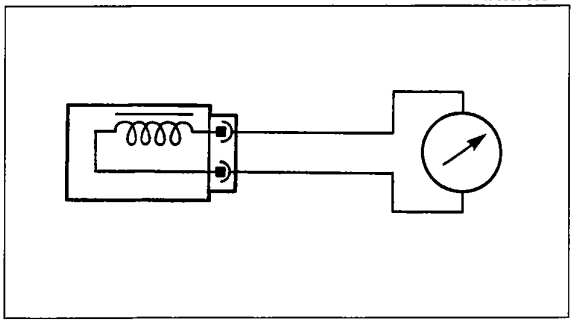

4F033J01




4F033PJ02




4F033PJ03



4F033PJ04

## FUEL MANIFOLD

The fuel manifold, which has the task of distributing the fuel to the injectors, is made from die-cast aluminium and incorporates the seats for the injectors and the air bleed valve.
The fuel intake is achieved by means of a rapid attachment. Since the system is the returnless type, there is no recirculation pipe.

1. Fuel manifold
2. Injectors
3. Fuel arrival connector
4. Bleed valve

## INJECTORS

The injector is designed to provide the quantity of fuel needed for the operation of the engine: the fuel is injected into the inlet manifold, immediately upstream of the inlet valves.
The injector is the top-feed type, with the supply of fuel from the top part of the body where the electrical winding connected to the connector (3) terminals is also housed.
When the current flows through the winding, the magnetic field which is created attracts the shutter causing the opening of the injector and the flow of fuel.
Two seals ensure the fuel manifold (1) side seal and the inlet manifold side (2).
**A** reference (4) determines the angular position of the injector and the correct direction of the jets in relation to the inlet valves.

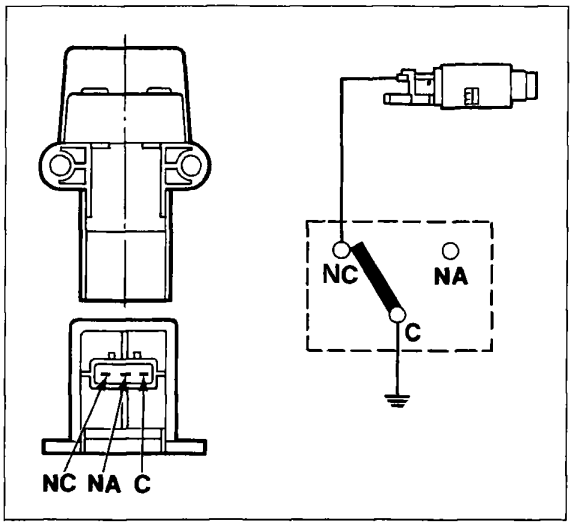
### Connector wiring

The injector resistance can be measured by disconnecting the connector and connecting an ohmmeter as illustrated in the diagram.

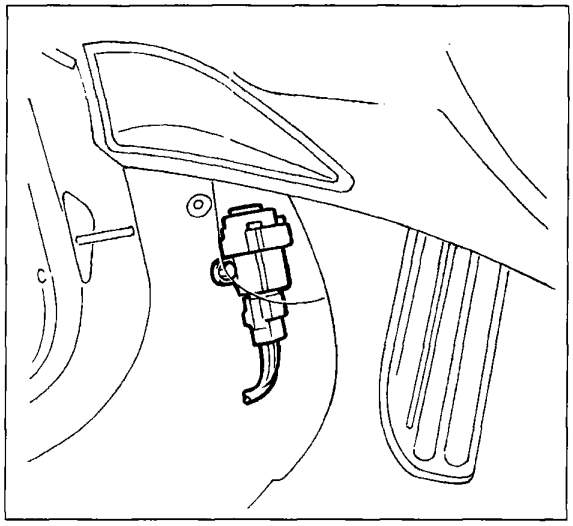
**Resistance value: 14.5 5%±ohm.**



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4F034PJ01



4F034PJ02

## INERTIA SAFETY SWITCH

The inertia switch has the task of cutting off the electrical supply for the electric fuel pump if the vehicle suffers violent deceleration (impacts) to prevent the escape of fuel in case the fuel manifold or the supply pipe is damaged with a consequent risk of fire.

The switch consists of a steel ball fitted in a conical shaped housing kept in position by the attraction force of a permanent magnet.

Under the action of the acceleration due to inertia forces, the ball may be released from the magnetic clip and gradually come out of the conical housing with an upwards movement which depends on the angle of the cone.

There is a rapid release mechanism located above the ball which forms a normally closed (**NC**) circuit. When the mechanism is struck by the ball, it changes position into a normally open (NA) circuit, thereby interrupting the electrical supply to the electric pump and causing it to cut out.

The calibration of the switch causes it to intervene at acceleration above 1.2 g (approx 11.7 m/s2, corresponding to an impact at a speed of around 25 km/h).

To restore the connection to earth for the auxiliary electric pump, the seat must be moved backwards and the switch pressed until a click is heard.

*After even an apparently slight impact, if there is a smell of fuel or there are leaks from the fuel system, do not turn the switch back on, but search for the cause of the problem and remedy it to avoid the risk of fire.*

*If there are no leaks and the vehicle is ready to depart once again, press the button to reactivate the electric pump.*



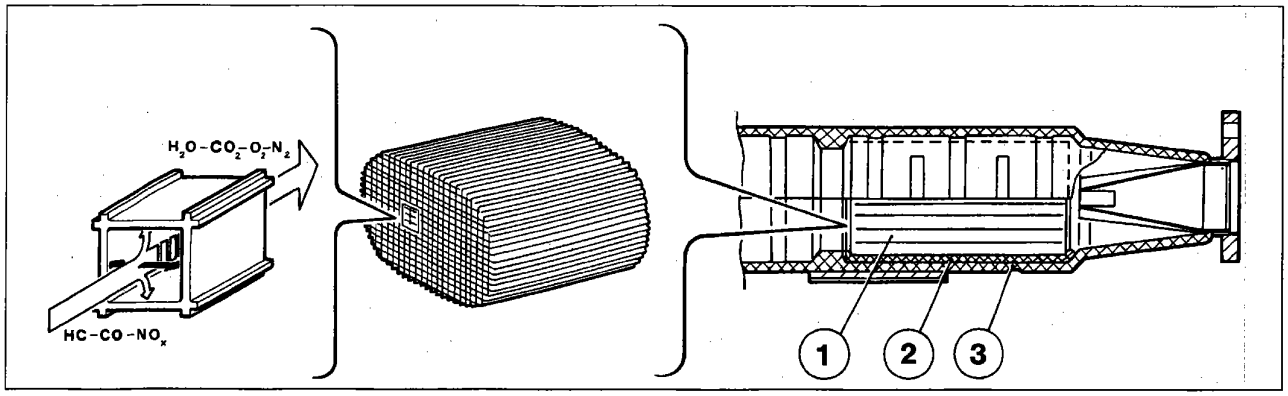
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## EMISSION CONTROL DEVICES

The devices used for this purpose have two objectives;
- to keep down the levels of the pollutant substances in the exhaust, through the catalytic silencer;
- to eliminate the outwards dispersion of unburnt hydrocarbons, through the (fuel) anti-evaporation system and the (lubricant) oil vapour recirculation system.

## CATALYTIC SILENCER

The catalytic silencer is a device which makes it possible to simultaneously keep down the levels of the three main pollutant compounds present in the exhaust: unburnt hydrocarbons (HC), carbon monoxide (CO) and nitrogen oxides (NOx).
Two types of chemical reaction take place inside the catalyzer:
oxidation of the CO and HC, converted into carbon dioxide ($CO_2$) and water ($H_2O$);
reduction of the NOx, converted into nitrogen ($N_2$ ).
These reactions can take place in extremely short periods of time thanks to the presence, inside the catalyzer structure (ceramic support), of a layer of active substances (platinum and rhodium) which enormously accelerate the conversion speed of the harmful substances.
The efficiency of this conversion process is, however, conditioned by the fact that the mixture strength for the engine must be continuously fluctuating around the stoichiometric value which is achieved thanks to the feed back control which is carried out by the control unit on the basis of the Lambda sensor signals.
Lastly, the conversion processes are activated at temperatures above 300-350 °C: it is therefore vital for the catalyzer to reach this temperature as quickly as possible in order to be able to operate correctly.




4F035PJ01

1. Ceramic monolith
2. Metal support
3. Steel outer casing

*When operations have to be carried out near the catalytic silencer, the vehicle must be left to rest for some time because the operating temperature inside the catalyer is between 500 and 850 °C.*

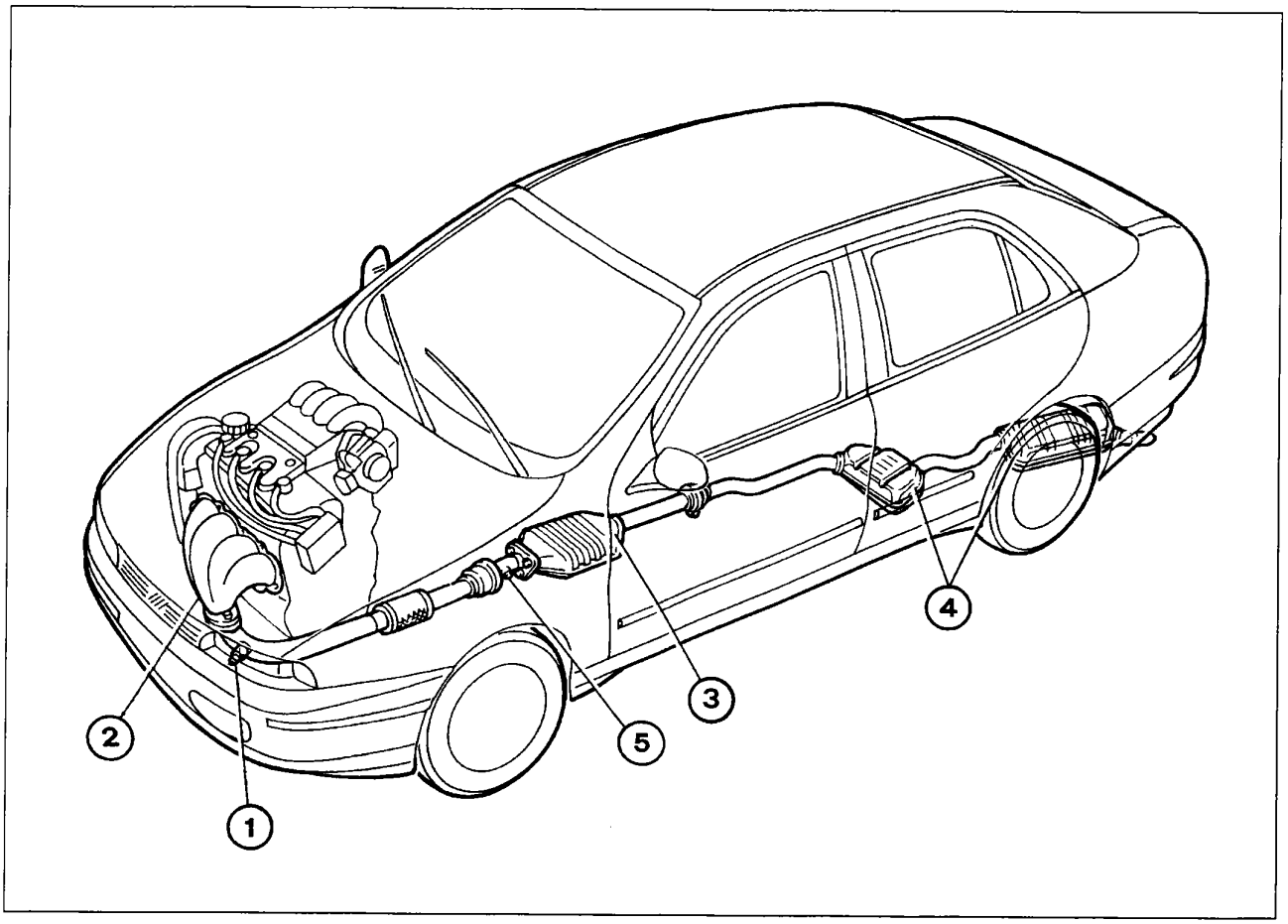
*There are basically two things which cause the destruction of the inside of the catalyzer, namely:*
- *the presence of lead in the fuel, which lowers the degree of conversion to levels which are practically nil ("lead poisoning") and also irreparably damages the Lambda sensor;*
- *the presence of totally unburnt fuel in the exhaust gases, due to failed ignition, which causes an increase in temperature which leads to the ceramic support melting. As a result, the high tension leads should not be disconnected, under any circumstances, with the engine running: when carrying out tests, the silencer must be replaced with a suitable length of pipe.*



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# 10.

## ENGINE EXHAUST ASSEMBLY DIAGRAM




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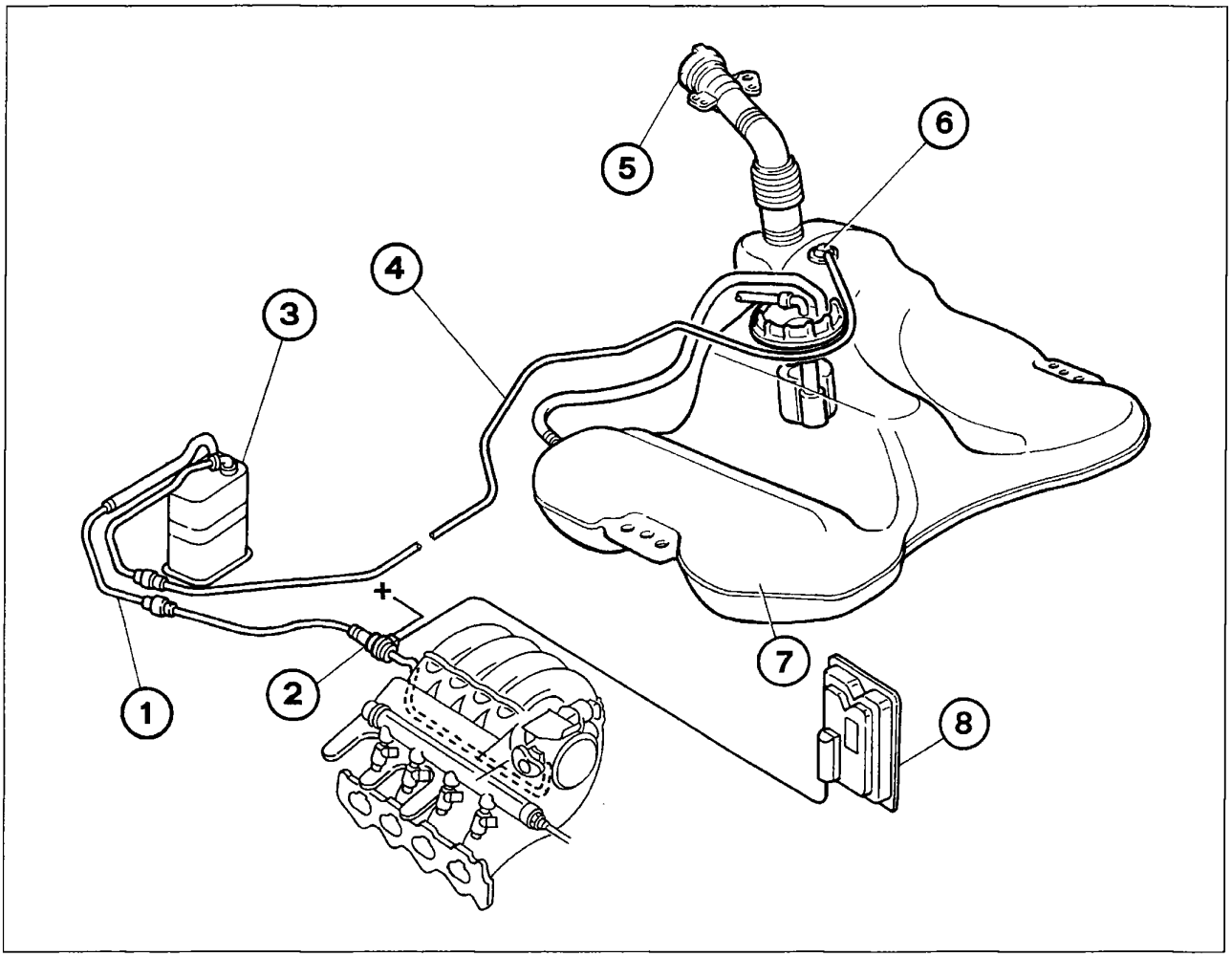
### Key

1. Lambda sensor
2. Exhaust manifold
3. Catalytic silencer
4. Silencer
5. CO socket



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## ANTI-EVAPORATION CIRCUIT DIAGRAM




4F037PJ01

The anti-evaporation system is designed to prevent the fuel vapours, consisting of the lightest fractions of hydrocarbons which basically form in the tank, from being discharged into the atmosphere.

1. Vapour supply pipe to the butterfly casing
2. Charcoal filter solenoid valve
3. Charcoal filter
4. Vapour supply pipe from the tank to the charcoal filter
5. Safety and ventilation valve
6. Multi-purpose valve
7. Tank
8. Injection/ignition control unit



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# 10.

## ANTI-EVAPORATION SYSTEM COMPONENTS

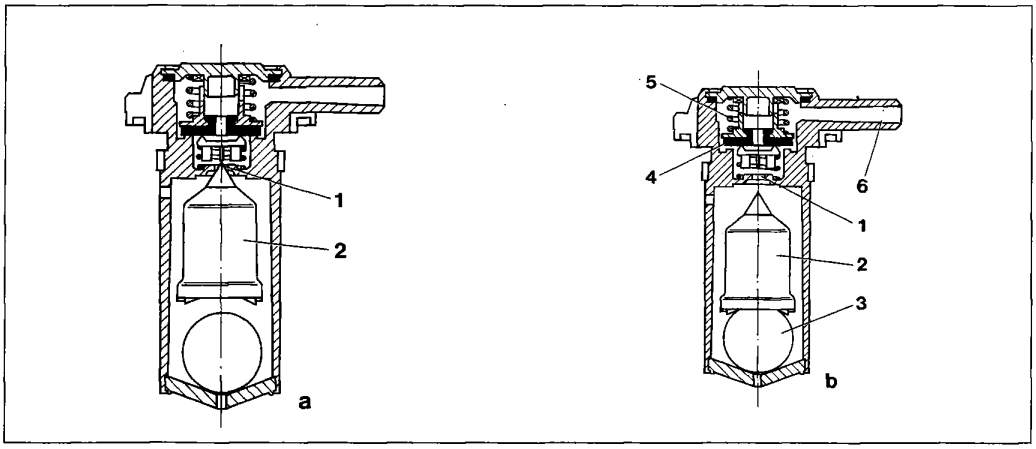
Multi-purpose valve

This valve is used to carry out various functions, namely:

- preventing the flow of liquid fuel, if the tank is too full or if there is an accident during which the vehicle overturns.
- allowing the breathing of fuel vapours toward the active charcoal filter;
- allowing the ventilation of the tank if there is a vacuum in it.

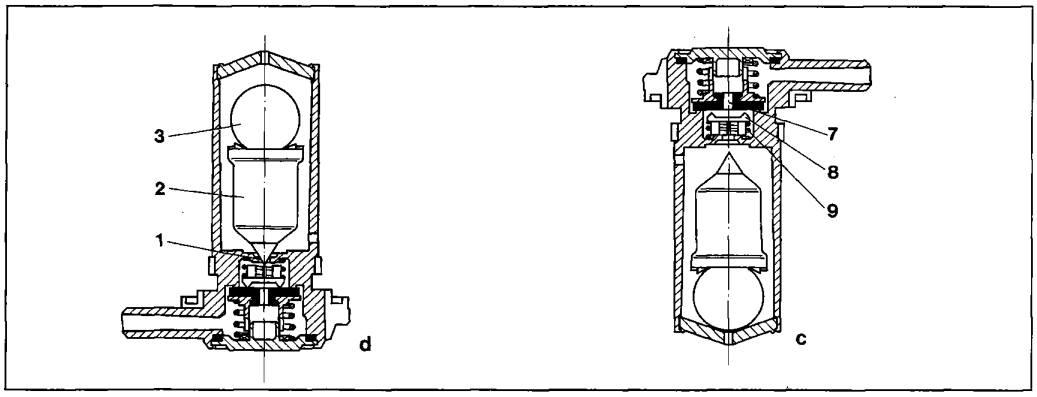
The valve consists of a float casing (2), a heavy ball (3), a plate thrust against the valve body by the spring (5) and a plate (8) thrust against the plate (4) by the spring (9). The operation of the multi-purpose valve can be summarized in the following cases, depending on how full the fuel tank is:

a. if the tank is full, the float (2) shutters the port (1) preventing the liquid fuel from reaching the active charcoal filter thereby avoiding damaging it;
b. if the level of the fuel in the tank decreases, the float (2) descends and rests on the ball (3), opening the port (1); when the pressure exerted by the fuel vapours on the plate (4) exceeds the loading of the spring (5), a ring section opens between the actual plate and the valve body, which allows the fuel vapours to flow out from the duct (6) and reach the active charcoal filter;




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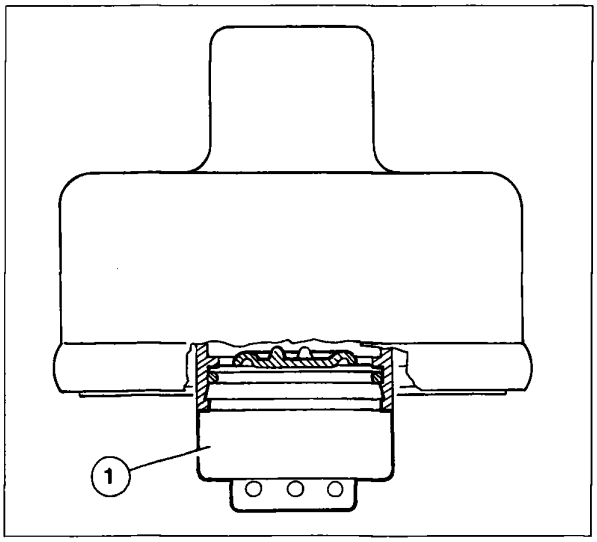
a. if the level of the fuel in the tank decreases to the extent that a vacuum is produced inside the tank, this vacuum acts on the plate (8) and, overcoming the spring (9) loading, recalls it downwards, allowing the ventilation of the tank through the port (7).
b. if the vehicle overturns, irrespective of how full the tank is, the ball (3), weighing on the float (2), pushes it against the port (1) preventing the dangerous escape of fuel and the consequent risk of fire.



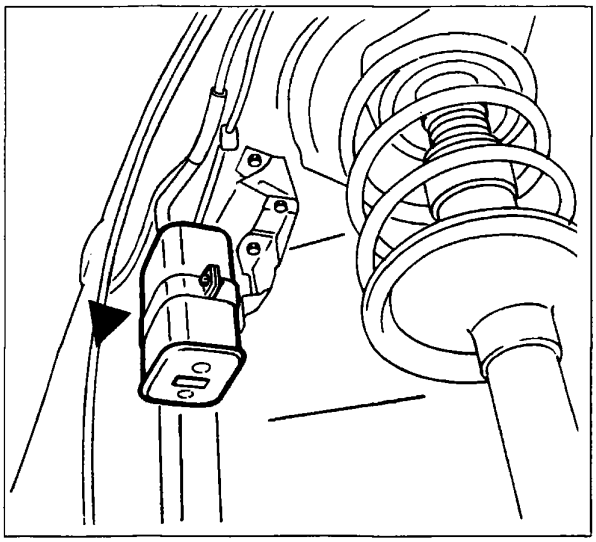

4F038PJ03 4F038PJ04



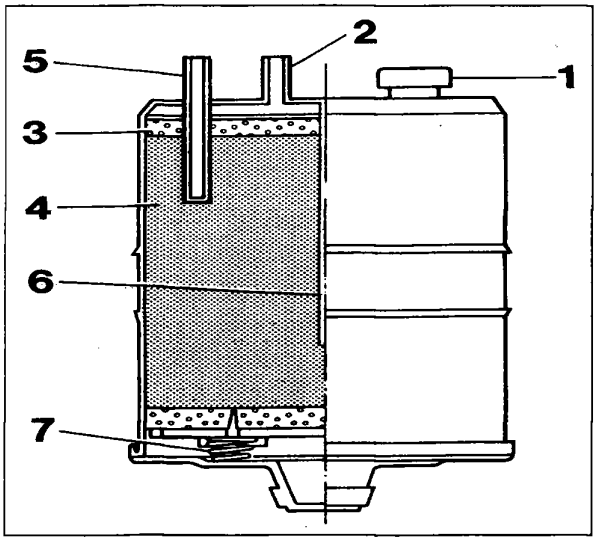
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4F039PJ01



4F039PJ02




4F039PJ03

### Safety and ventilation valve

This valve is located in the fuel filler cap and, according to the pressure in the tank, carries out the following functions:

- When the pressure inside the fuel tank exceeds 0.13 - 0.18 bar, it allow the excess vapours to be discharged outwards (safety function).
- If, conversely, a vacuum forms inside the tank equal to 0.020 - 0.030 bar, it allows the introduction of air (ventilation function).

### Charcoal filter

The charcoal filter is located in the right wheel arch; to gain access to it the rear part of the right front wheel arch liner has to be removed.

It consists of granules of charcoal (4) which trap the petrol vapours entering through the intake (5).

The air which enters through the intake (1) and the paper filter (3) comes into contact with the granules and directs them to the outlet (2) and from there to the cut out valve.

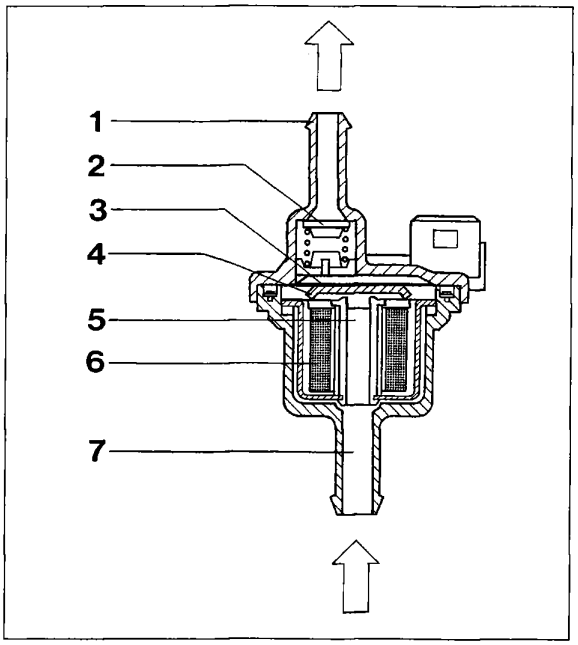
The air, having entered through the intake (5), can also be recalled by the vacuum in the tank for ventilation purposes. The partition (6) ensures that the intake air comes into contact with all the granules of charcoal, enhancing the release of petrol vapours to the inlet manifold.

There are also two springs (7) which allow the expansion of the mass of granules when the pressure increases.

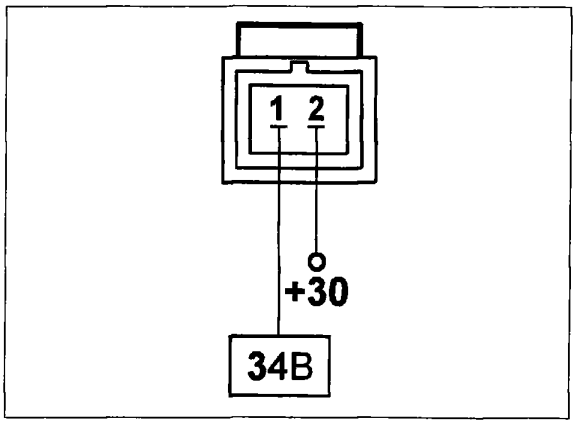


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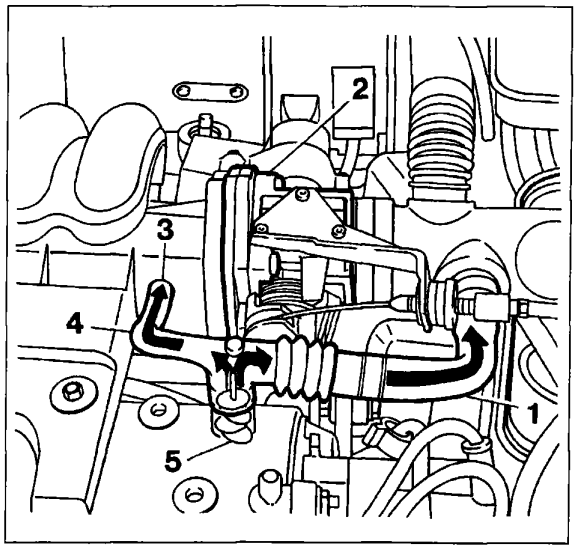
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4F040PJ03

## Charcoal filter solenoid valve

The function of this valve is to control the quantity of fuel vapours drawn in by the active charcoal filtr and directed to the inlet manifold which is achieved by means of the injection/ignition electronic control unit.

If this valve is not supplied, it is closed, preventing the fuel vapours from excessively enriching the mixture.

1. Inlet connector
2. Single-acting valve
3. Spring
4. Shutter
5. Outlet port
6. Electro-magnet
7. Outlet connector

## Connector wiring

## DIAGRAM SHOWING EXCHANGE OF GASES COMING FROM THE CYLINDER BLOCK/CRANKCASE (BLOW-BY)

This system controls the emission, from the cylinder block/crankcase, of breather gases consisting of air/petrol mixtures and burnt gases which escape from the piston seals, in addition to lubricant oil vapours, recirculating them to the inlet.
With the accelerator butterfly open, the gases from the upper cover reach the main air inlet pipe through the pipe (1) which contains a flame damper (5) to prevent combustion due to flame returns from the butterfly casing (2).
With the accelerator butterfly closed (engine idling), the vacuum in the inlet manifold draws in the gases (in limited quantities) directly through the small pipe (4) and the calibrated port (3).



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## CHECKS, ADJUSTMENTS AND REPAIR OPERATIONS ON THE BOSCH M1.5.5 SYSTEM

*When working on a vehicle equipped with a Bosch M1.5.5 system, observe the following precautions:*
- *do not start up the engine with the electrical connection terminals not properly connected or slack at the battery poles;*
- *do not use a rapid battery charger for starting up the engine;*
- *never disconnect the battery from the electrical system with the engine running;*
- *to charge the battery, disconnect it first from the electrical system;*
- *if the vehicle has to go in a drying oven after painting at temperatures in excess of 80 °C, then the engine control unit must be removed from the vehicle;*
- *do not connect/disconnect the control unit multiple connectors with the ignition switch in the ON position;*
- *always disconnect the negative battery lead before carrying out electrical welding on the vehicle.*

*The system has a memory which is directly supplied by the battery, even when the ignition is switched off, which contains the values obtained during self-adjustment. Disconnecting the battery will mean that this information is lost and can only be acquired again after a certain length of time: this operation should therefore be restricted as far as possible.*

## CHECKING THE CONCENTRATION OF THE EMISSIONS

The system manages the advance, the carbon monoxide (**CO**) content and the idle air flow rate without the possibility for adjustments, threfore no manual regulations are required. However, a check on the content of th exhaust gases, upstream and downstream of the catalyzer can provide precious indications on the injection/ignition system operating conditions, the engine parameters and the catalyzer.

### Checking the idle CO and HC concentration upstream of the catalytic silencer

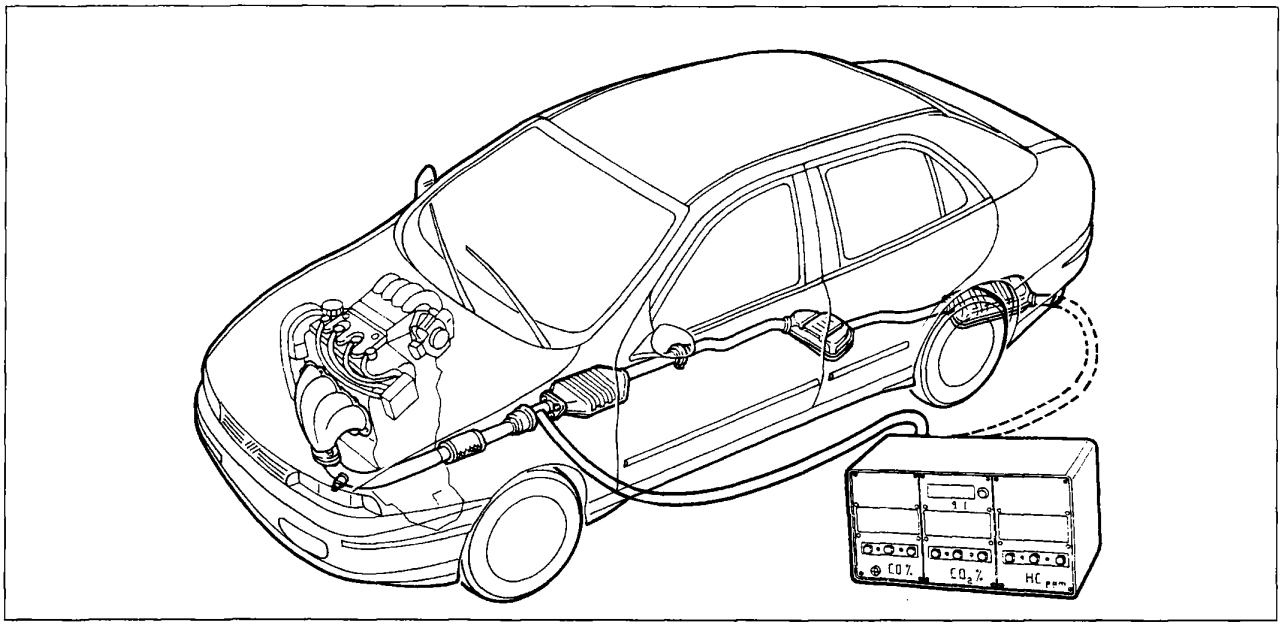
To check the concentration of carbon monoxide (CO) and unburnt hydrocarbons (**HC**) upstream of the catalyzer, proceed as follows:

1. Undo the plug on the exhaust pipe, upstream of the catalyzer, and tighten the tool in its place.
2. Connect a suitably calibrated **CO**-tester probe to the tool.
3. Start up the engine and let it reach operating temperature.
4. Check that the engine speed is correct.
5. Check that the idle **CO** concentration is within the recommended limits (see table); if this is not the case, it is necessary to check:
   - that the Lambda sensor is working properly, using the diagnostic equipment;
   - for the presence of air penetration in the area surrounding the Lambda sensor housing;
   - the injection and ignition system (in particular the state of the spark plugs).
6. In the same conditions, check that the **HC** concentration is below 500 p.p.m.
7. If these figures are not obtained, proceed with tuning the engine, in particular checking the:
   - valve gear timing;
   - engine compression.

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Table summarizing pollutant emission tolerance values

| | CO (%) | HC (p.p.m.) | $CO_2$ (%) |
|---|---|---|---|
| Upstream of the catalyzer | 0.4 - 1 | ⩽ 500 | ⩾ 12 |
| Downstream of the catalyzer | ⩽ 0,35 | ⩽ 90 | ⩾ 13 |

Checking exhaust concentration of CO and HC

The concentration of carbon monoxide (CO) and unburnt hydrocarbons (HC) at the exhaust is measured by inserting a suitably calibrated tester probe at least 30 cm into the end of the exhaust pipe.

1. Check that the idle CO and HC concentration values are those recommended in the table.
2. If the HC value is outside of the recommended limit, whilst that measured previously upstream of the catalyzer was correct, the engine parameters are correct and therefore the cause of the problem should be sought in the decreased efficiency of the catalyzer.

## ENGINE IDLE SPEED CHECK

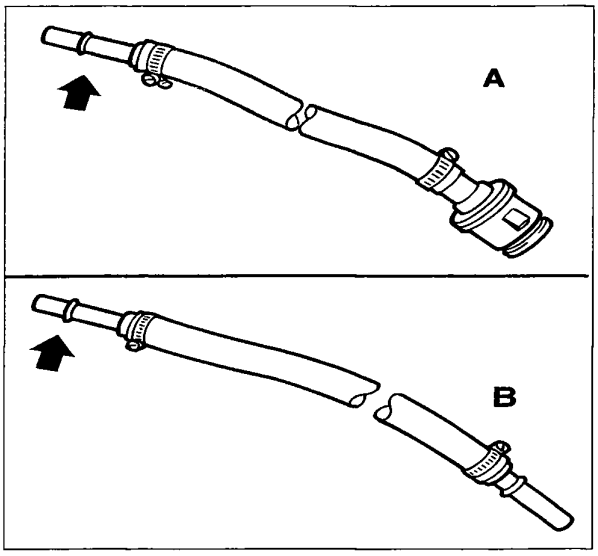
If the engine idle speed does not correspond to the recommended value and the system is the self-regulating type then no adjustment can be carried out. It is therefore necessary to check that the accelerator linkage is correctly adjusted and then the cause of the problem should be sought by carrying out a complete fault diagnosis using the diagnostic equipment.

## IGNITION ADVANCE CHECK

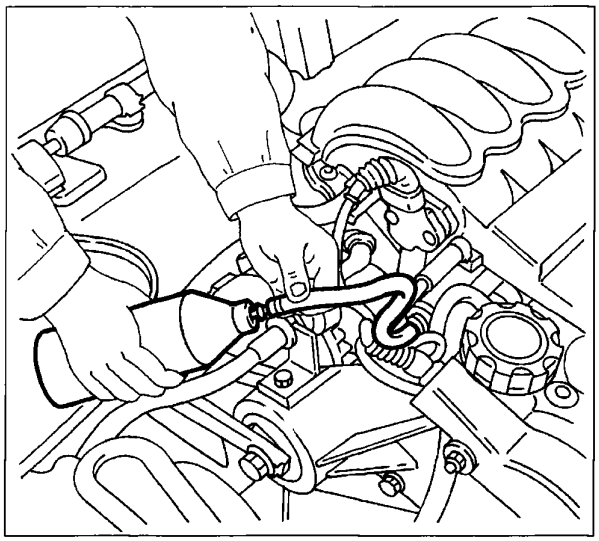
The diagnostic equipment must be used to check the ignition advance angles at the various speeds.



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Draining supply circuit fuel pressure

## CHECKS ON FUEL SUPPLY CIRCUIT

*CARRY OUT THESE OPERATIONS IN THE PRESENCE OF A SUITABLE VAPOUR PURIFICATION AND EXHAUST SYSTEM*

### Fuel supply circuit pressure check

Check the fuel supply pressure and the fuel system seal following the instructions given below using the equipment 1860955000 with two adaptors to be constructed as described below:
- adaptor (A): use a new type female terminal for rapid attachment and a length of pipe contained in Kit No. 186095503 and an old type male terminal for rapid attachment contained in Kit No. 1860955001;
- adaptor (B): use a new type male terminal for rapid attachment and a length of pipe contained in Kit No. 1860955003 and an old type male terminal for rapid attachment contained in Kit No. 1860955001;

Configure the adaptors as illustrated in the diagram.

*The arrow shows the side to insert in the test equipment 1860955000 (pressure gauge)*

The fuel supply circuit is kept at a constant pressure of about 3.2 bar even when the engine is switched off; therefore, before carrying out any operations to the supply pipe it is necessary to drain the pressure in the system using the adaptor no. 1870684000 and a special container into which to drain the excess fuel. Proceed as described below:
- Remove the protective cover from the attachment on the fuel manifold;
- introduce the male terminal for the adaptor inside the container and insert the rapid connector on the attachment on the fuel manifold, as illustrated in the diagram; in this way the small amount of excess fuel, which creates pressure, is drained into the container and the test procedures can then be carried out on th fuel supply system;
- disconnect the adaptor from the attachment and refit the protective cover.

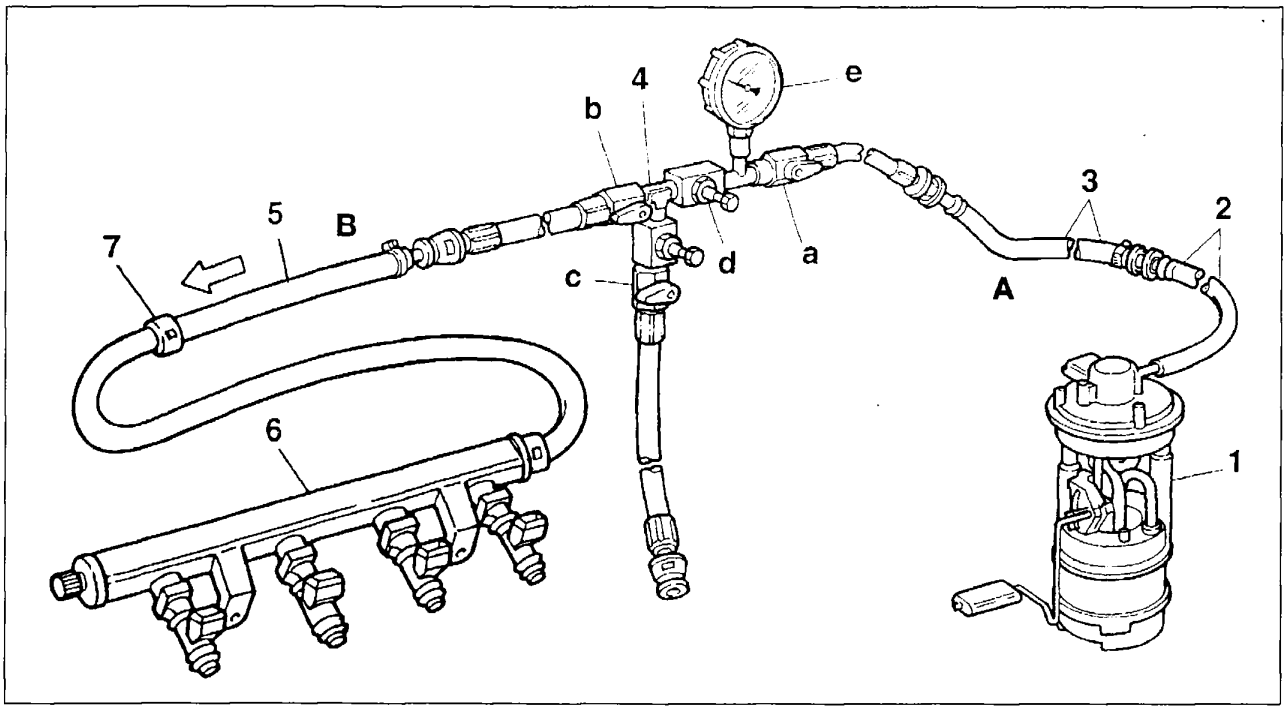


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## Fuel supply circuit pressure check

Prepare the test equipment 1860955000 using the adaptors produced previously and fitted as illustrated in the diagram below using the valves (a), (b) and (d) in the maximum opening position and valve (c) in the closed position.




4F044PJ01

1. Complete electric pump
2. Fuel supply pipe
3. Adaptor (A)
4. Test equipment No. 1860955000
5. Adaptor (B)
6. Fuel manifold
7. Rapid attachment connector

After having discharged the pressure, remove the terminal for the fuel supply pipe (2) from the rapid connector (7) following the instructions given on the previous pages, connect it to the female connector for the adaptor (A), connect the new male terminal for the adaptor (B) to the rapid connector (7) and check that the connectors are properly fitted.
Turn the ignition key to the ON position and check on the pressure gauge (e) that after having increased to a value of about 3.5 bar, the pressure settles down at around 3.2 bar (the decrease in pressure is due to the fact that after operating for several seconds the pump cuts out if the engine is not started up).
If there is a decrease in pressure greater than the figures given above, check the seal of the system in the section upstream of the fuel manifold and check the seal of the injectors following the instructions given below.

### Checking fuel supply pipe seal

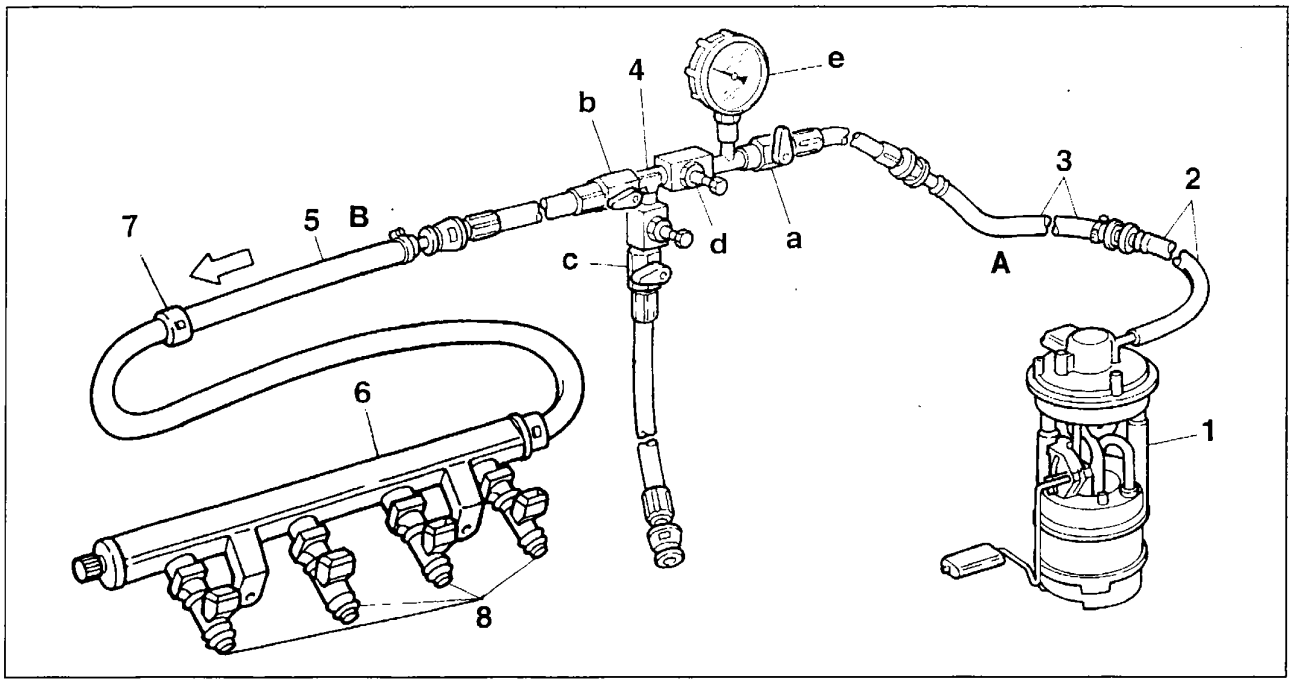
Keep the test equipment prepared as described in the previous paragraph, close valve (b), keeping valve (c) closed and valve (a) in the fully open position.
Turn the ignition key to the ON position and check on the pressure gauge (e) that the pressure, after rising to around 3.5 bar, settles down to around 3.2 bar (the decrease in pressure is due to the fact that the pump cuts out after operating for several seconds if the engine is not started up).



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If there is a decrease in pressure greater than the figures given above, check the seal of the system in the section upstream of the manifold and, if there are no leaks or damage to the fuel supply pipe, replace the electric fuel pump drip tray assembly because the pressure regulator is housed in this unit and CANNOT be replaced.
If the pressure, after having repeated the test, exceeds the recommended figure and is considerably higher, replace the electric fuel pump because there iare operating faults in the pressure regulator.
If the pressure corresponds to the recommended figure, check the seal of the fuel manifold and the injectors, following the procedure described in the next paragraph.

Injector seal check




4F045PJ01

1. Complete electric pump
2. Fuel supply pipe
3. Adaptor (A)
4. Test equipment No. 1860955000
5. Adaptor (B)
6. Fuel manifold
7. Rapid attachment connector
8. Injectors

Keep the test equipment configured as described in the previous paragaph, close valve (b), keeping valve (c) closed and valve (a) in the fully open position.

Turn the ignition key to the ON position and check on the pressure gauge (e) that, after having increased to a value of around 3.5 bar, the pressure settles down at around 3.2 bar, then close the valve (a) and check that the pressure remains constant for at least one minute; if this is not the case, there is a leak from one or more of the injectors.

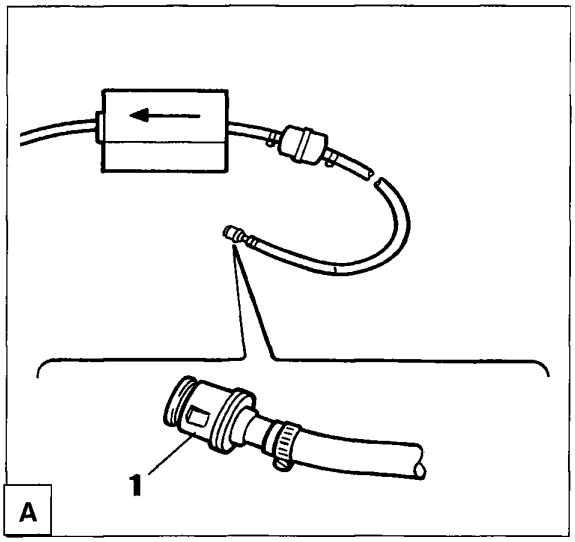
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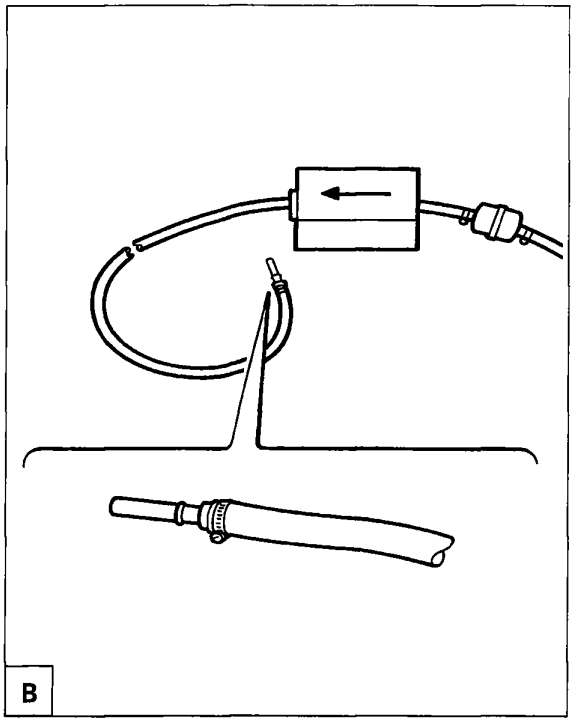
# 10.

## Removing test equipment

Remove the test equipment 1860955000 with the ignition key in the OFF position proceeding as follows:
- introduce the end of the pipe connected to the valve (c) in a suitable container;
- open the valve (c) and drain the excess fuel into the container;
- keep the pipe in the container and disconnect the end of the supply pipe from the female connector for adaptor (A) holding the connector upwards;
- let the fuel in the pipes flow into the container;
- disconnect the end of the adapator (B) from the rapid connector and let the fuel flow from the pipes into the container;
- reconnect the fuel supply pipe.




4F046PJ01




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Check the fuel consumption using the FLOWTRONIC equipment 1866149001

To carry out the test the equipment must be configured with the connectors as illustrated in the diagrams:

A. supply pipe side

B. fuel manifold side

If this is not the case, carry out the adjustment, following the instructions given below:

– cut the end of the inlet pipe for the FLOWTRONIC equipment and replace it with a femal rapid connector (1), contained in Kit No. 186095503, as illustrated in figure A;

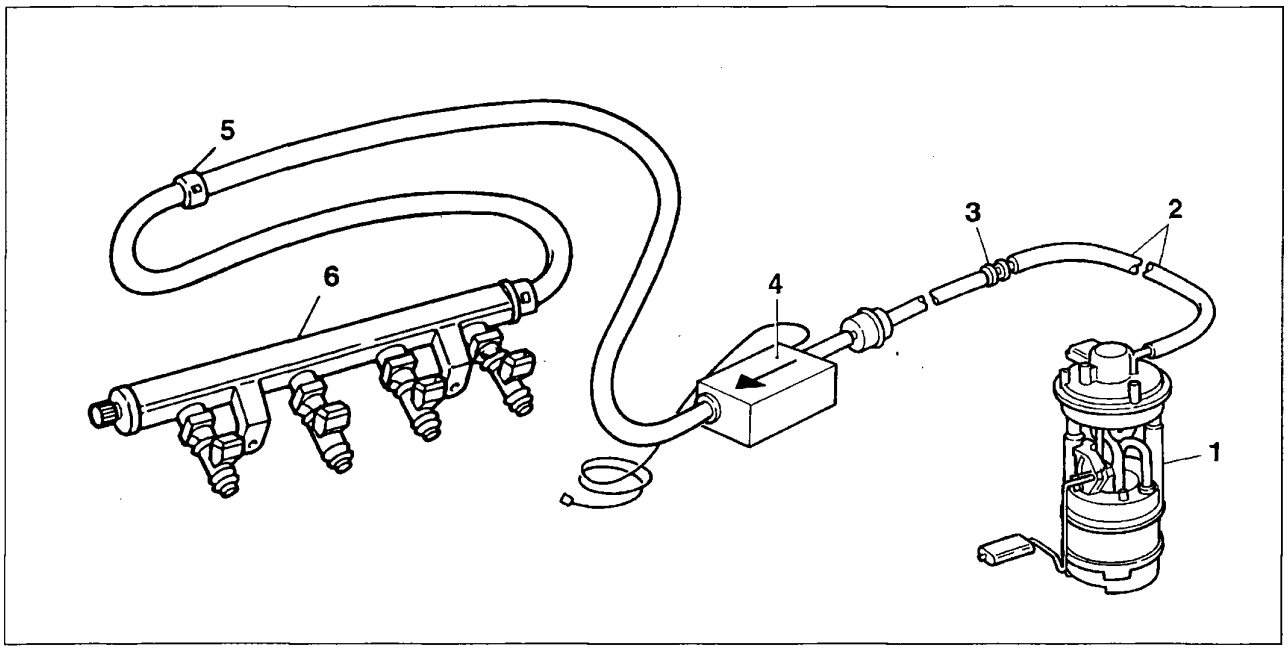
– cut the end of the outlet pipe for the FLOWTRONIC equipment and replace it with a male connector (2), contained in Kit No. 1860955003, as illustrated in figure B.

*The connectors which have been removed should be recovered and kept for future connections.*



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- discharge the fuel prssure inside the supply pipe and disconnect the pipe from the rapid connector, following the instructions given in the previous paragraphs;
- connect the end of the supply pipe to the female rapid connector for the FLOWTRONIC equipment and the male connector to the rapid connector;
- position the equipment in the engine compartment, place the electrical connecting cable inside the vehicle and connect the actual equipment as described in the instructions which come with the equipment;
- proceed with checking the fuel consumption in accordance with regulation 93/116 CE and check that the figures correspond to those in section 00 - Technical Data.




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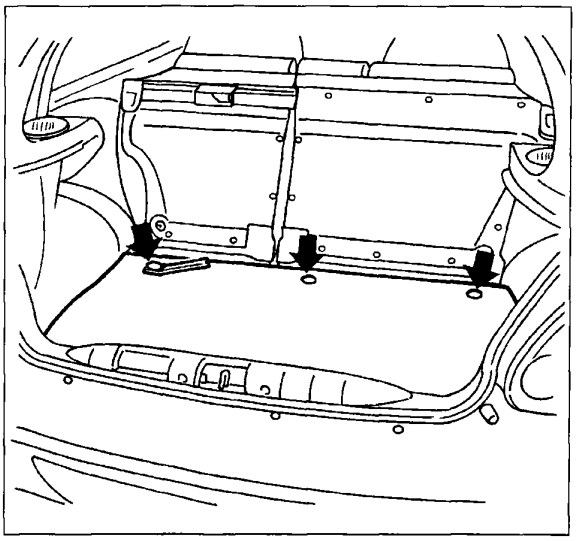
1. Complete electric pump
2. Fuel supply pipe
3. Female rapid connector
4. FLOWTRONIC equipment
5. Rapid connector
6. Fuel manifold

- carry out the fuel consumption road test in accordance with directive 93/116 CE (litres per 100 km)
  URBAN CYCLE - includes a cold start, followed by a varied simulated urban journey;
  EXTRA-URBAN CYCLE - includes frequent acceleration, in all gears, simulating normal out of town usage of the vehicle; the speed varies between 0 and 120 km/h;
  AVERAGE COMBINED CONSUMPTION - includes 33% of the urban cycle and 67% of the extra-urban cycle;
  check that the values measured correspond to those in the section "Introduction and Technical Data".

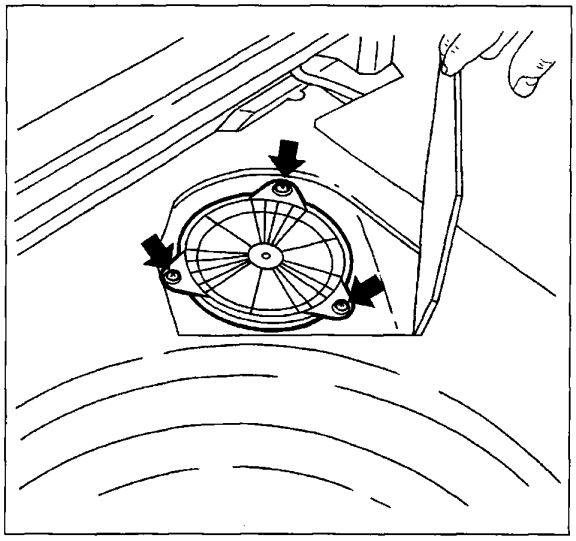
NOTE *Traffic conditions, driving styles, atmospheric conditions, trim levels/accessories, the presence of a roof rack, special equipment and the state of the vehicle in general can lead to fuel consumption figures which differ from those obtained using the procedures described above.*



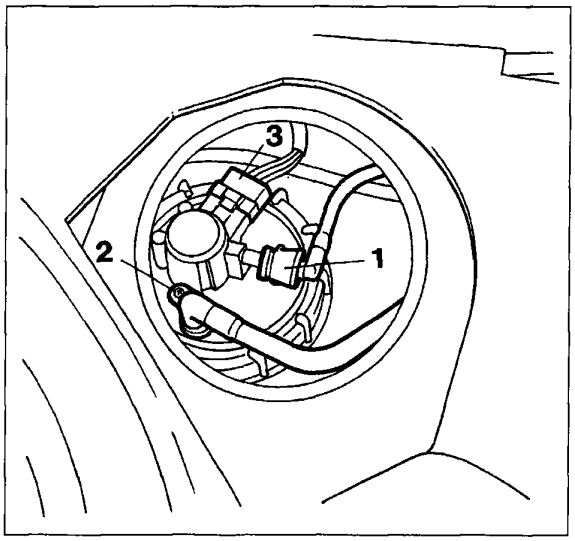
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## FUEL DRIP TRAY ASSEMBLY

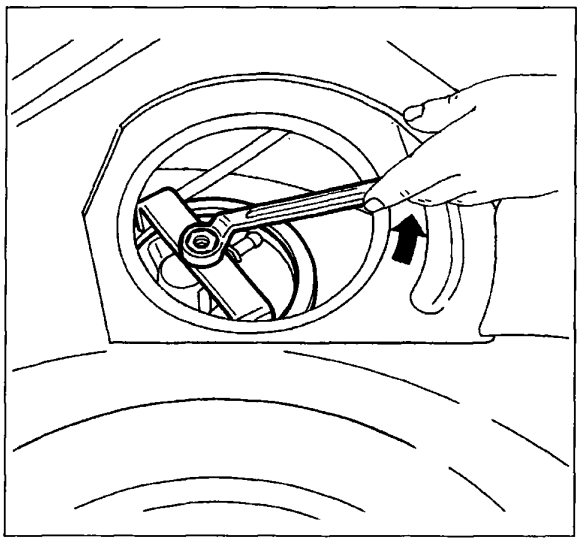
**NOTE** *In order to extract the unit from the tank, the fuel should not come above the maximum level.*

### Removing-refitting

Proceed with the removal of the fuel drip tray assembly as follows:

- using tool 187807700, remove the buttons (arrow) fixing the luggage compartment lining and remove it, then lift up the cover to gain access to the dust cover;
- undo the bolts (arrow) and remove the dust cover; _ disconnect the supply pipe (1), the breather pipe (2) and the electrical connector (3);
- using the tool 1860893000, remove the ring nut securing the drip tray amd extract the drip tray from the tank, taking care not to damage the seal.

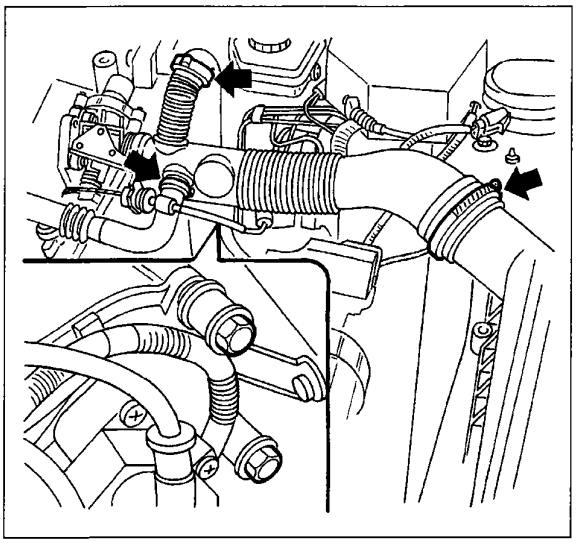
When refitting, reverse the order of the operations carried out for the removal; at the end, make sure that there are no fuel leaks.



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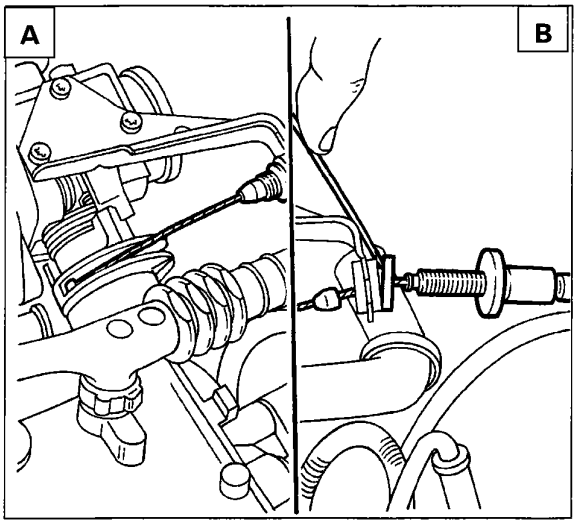
## FUEL MANIFOLD AND INJECTORS

**NOTE** *Before removing the manifold, discharge the pressure inside, following the instructions given at the start of this chapter.*

### Removing-refitting fuel manifold

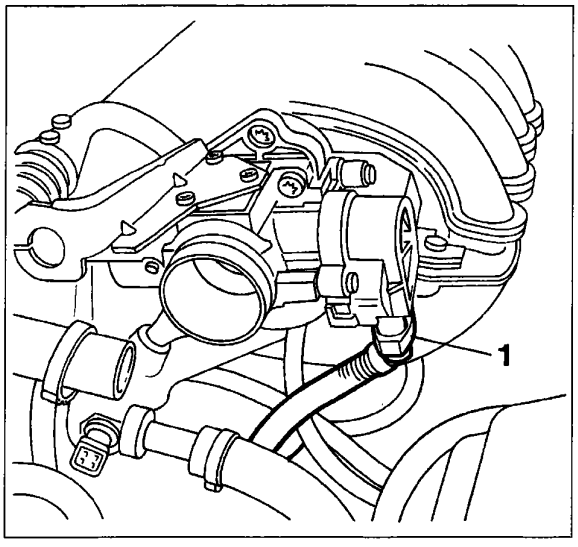
Proceed with the removal of the manifold as follows:

- remove the bands shown (arrow); then undo the two bolts (detail) and rmeove the inlet hose complete with resonator;

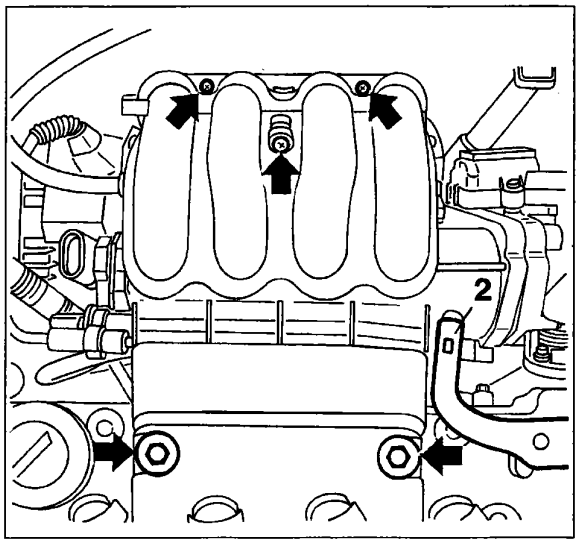



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- turn the accelerator lever and release the end of the accelerator cable from the lever (A), then remove the adjustment plate from the bracket (B) and move the accelerator cable away;
- disconnect the engine idle speed actuator connector (1);
- undo the bolts (arrow) fixing the upper half manifold and remove the vapour recirculation pipe (2).




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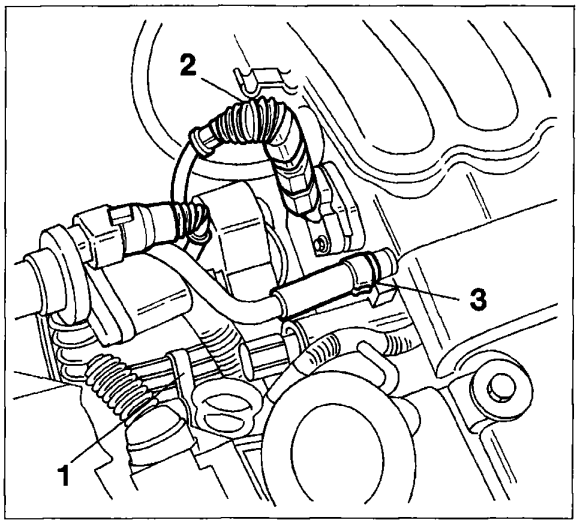



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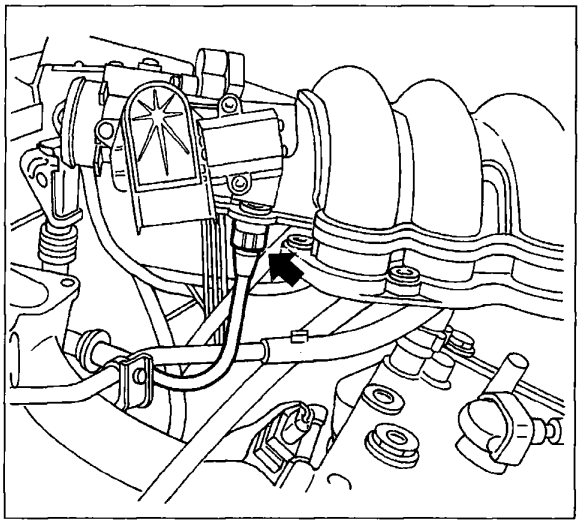


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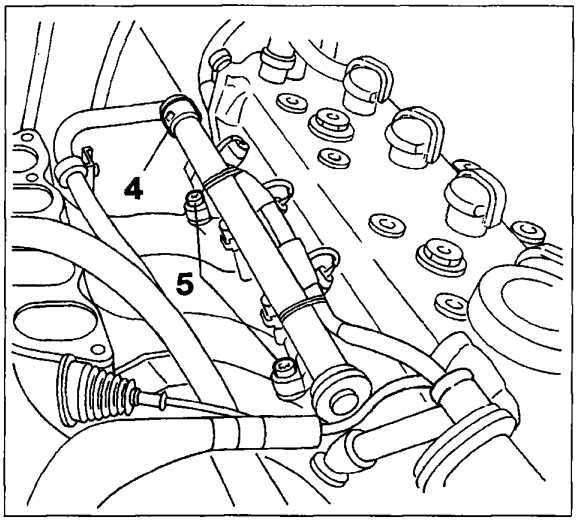
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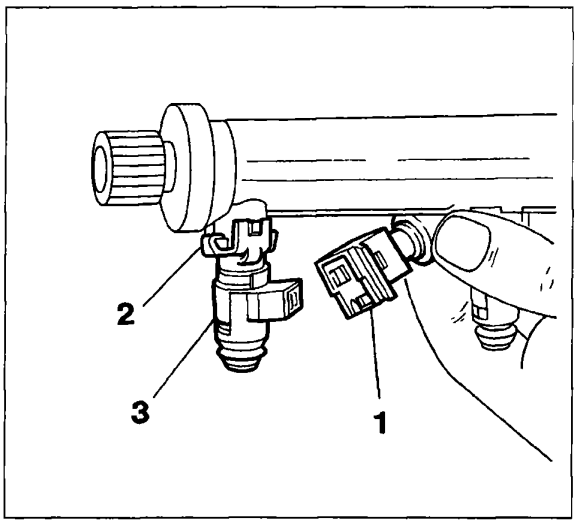
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- disconnect the pressure and air temperature sensor connector (2), the injector cable connector (1) and remove the charcoal filter intake pipe (3);
- partly raise the half manifold and remove the brake servo vacuum intake pipe (arrow);
- disconnect the rapid connector (4), undo the fixing bolts (5) then remove the complete fuel manifold.

When refitting, reverse the order of the operations carried out for the removal.




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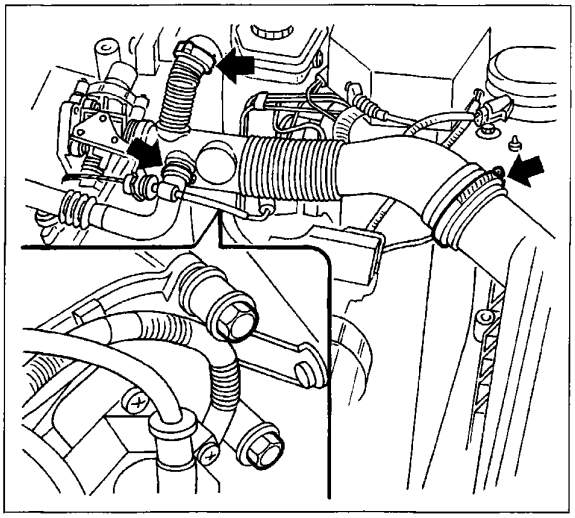
## Removing-refitting injectors

To remove the injectors, proceed as follows:
- Disconnect the electrical connection (1).
- Remove the safety clip (2).
- Remove the injecor (3) which is a press fit.

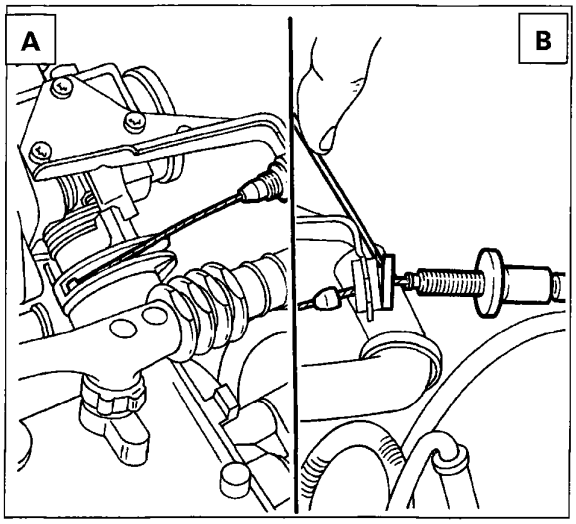
*Never act on the electrical connector to remove the injector.*
*Before refitting, check the condition of the seals.*



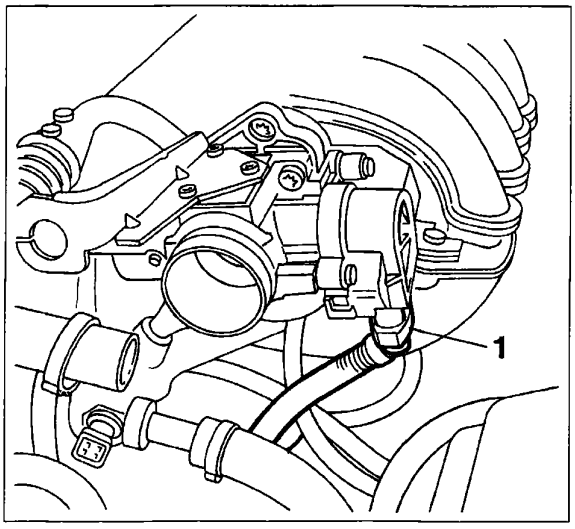
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## BUTTERFLY CASING

### Removing-refitting

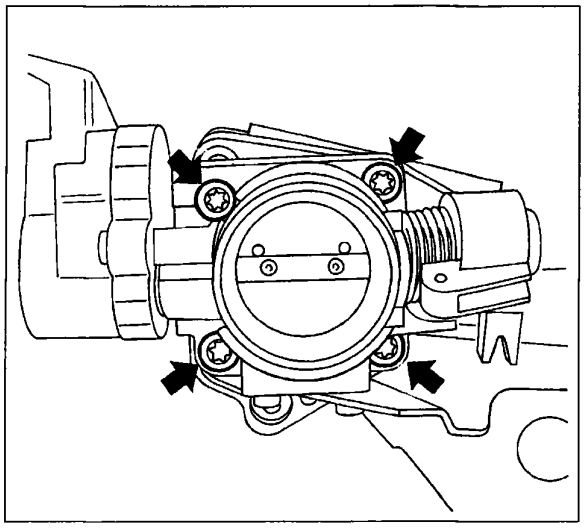
Proceed with the removal of the butterfly casing as follows:

- remove the bands illustrated (arrow); then undo the two bolts (detail) and remove the inlet hose complete with resonator;
- release the end of the accelerator cable from the lever (A) then remove the adjustment plate from the bracket (**B**) and move the accelerator cable away;
- disconnect the engine idle speed actuator connector (1);
- undo the four fixing bolts (arrow) and remove the butterfly casing.

When refitting, reverse the order of the operations carried out for the removal.

Adjust the accelerator control cable as described in the paragraph below.

**NOTE** *If the butterfly casing is being replaced, connect the diagnostic equipment (Examiner) to the diagnostic socket and carry out the zeroing and self-learning procedures for the engine idle adjustment actuator data (M.D.S.)*



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# 10.

## Zeroing

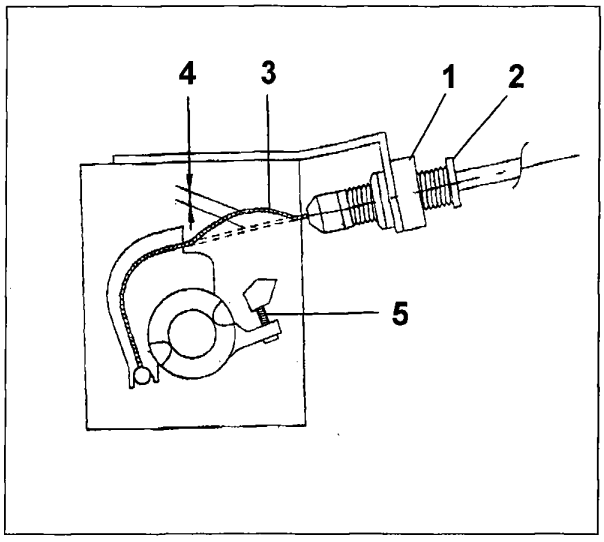
- Make sure that the ignition switch is in the OFF position.
- Check that the climate control is switched off, that the accelerator pedal is not pressed and the accelerator control cable is correctly adjusted (see paragraph below).
- Connect switch MPX 97 (tool 1806365000) to the diagnostic socket and place the knob in position 3.
- Connect the diagnostic equipment (Examiner).
- Using the Examiner, enter into the "Control Unit Test" ambient.
- Place the ignition switch in the ON position.
- Using the Examiner, enter the "Active Diagnosis" ambient, then select "Self-adjustment Parameters Reset" and "Idle Actuator".
- Confirm Reset and wait for the message "Carried Out".
- Turn the ignition switch to the OFF position and wait for 30 seconds.

## Self-learning

- Turn the ignition switch to the ON position and wait for 30 seconds.
- Using the Examiner, re-establish the dialogue with the engine control system.
- Using the Examiner, enter the "Parameters" ambient and in the "Select" menu select the "Idle recognition Test– carried out" and "Idle recognition signals – synchronized" checks.

**NOTE** *If at least one of the parameters does not conform, turn the ignition OFF and repeat the procedure. If the non conformity persists, check that the diagnostic cable is correctly connected and that the instrument is working properly.*

- Turn the ignition to the OFF position and wait for 30 seconds.
- Start up the engine without pressing the accelerator pedal and wait for the fan to come on.
- Disconnect the diagnostic equipment.
- Road test the vehicle for several kilometres then, with the engine warmed up, check that the idle is working properly.



4F052PJ01

## ACCELERATOR CABLE

### Adjustment

- loosen the lock nut (1);
- working on the adjustment nut (2), adjust the accelerator cable (3) clearance so that, with the pedal released, the butterfly is completely closed (adjustment screw 5 in end of travel position) and the cable clearance (4) is about 5 mm.

Proceed as described below:

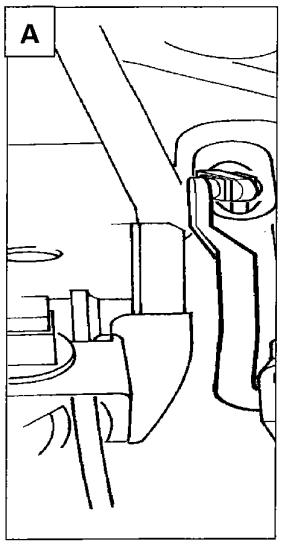
tighten to reduce the clearance
loosen to increase the clearance;

- when the adjustment has been completed, lock the lock nut.

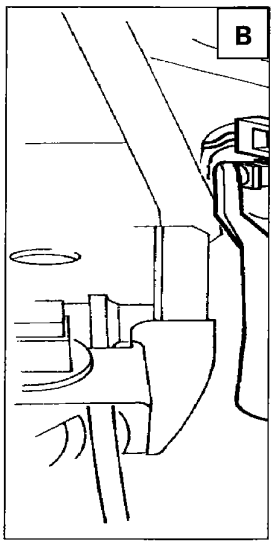
At the end of the adjustment of the cable during idling, connect the diagnostic equipment to the special intake and check that, with the pedal fully depressed, the opening angle of the butterfly is at least 80°.



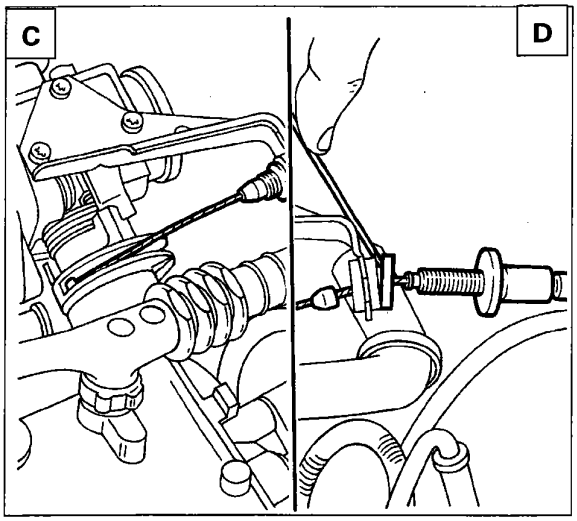
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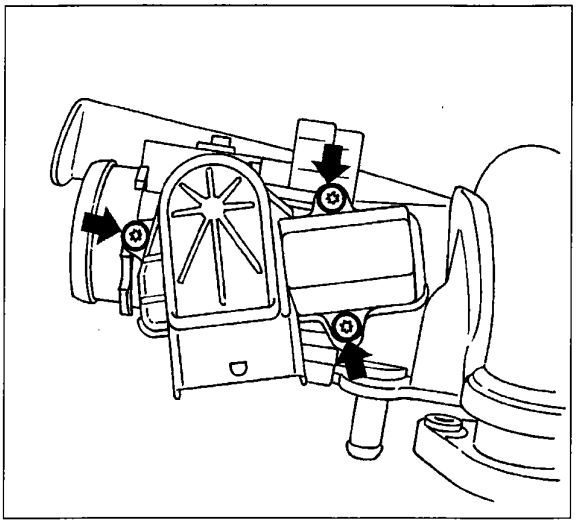
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4F049PJ02


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### Removing-refitting

Proceed with the removal of the accelerator cable as follows:

- working from inside the vehicle (A), disconnect the control cable from the mounting on the accelerator pedal (B);
- turn the accelerator lever to release the end of the accelerator cable from the lever (**C**), then remove the adjustment plate from the bracket (D) and move the accelerator cable away.

When refitting, reverse the order of the operations carried out for the removal.

## ENGINE IDLE ADJUSTMENT ACTUATOR/BUTTERFLY POSITION SENSOR

**NOTE** *The engine idle adjustment actuator/butterfly position sensor should only be disconnected from the butterfly casing if it is being replaced, because the removing-refitting causes the deterioration of some components (e.g. internal seals) which then do not guarantee the correct operation of the component once it is refitted.*

### Removing-refitting

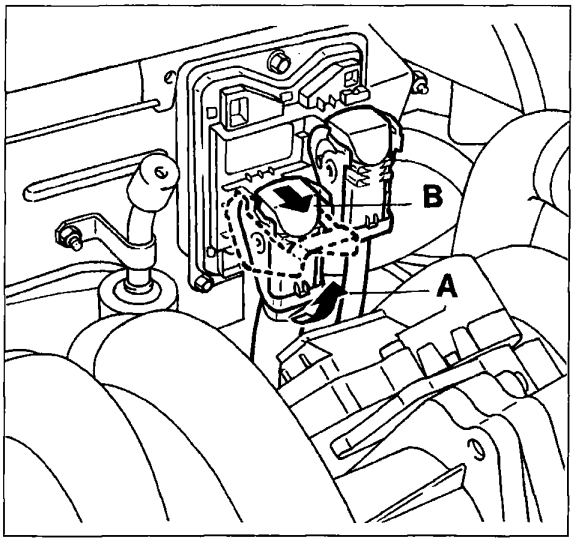
To remove the actuator, disconnect the connector and undo the fixing bolts (arrow).

**NOTE** *When refitting, the zeroing and self-learning procedures for the engine idle adjustment actuator data (M.D.S.) must be carried out as described in the "BUTTERFLY CASING" paragraph.*

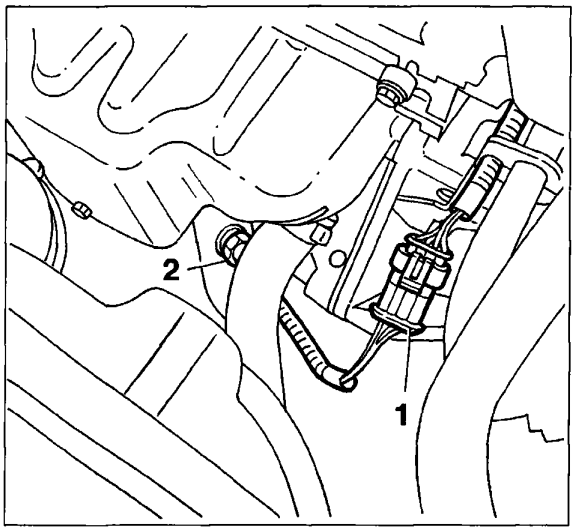


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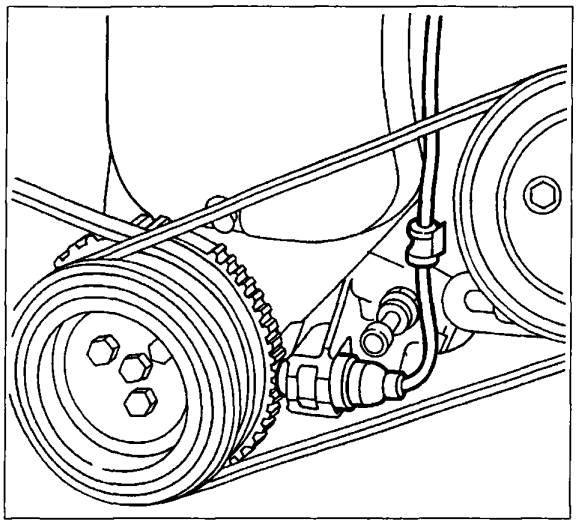
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## ENGINE CONTROL UNIT

### Removing - refitting

Proceed with the removal of the control unit as follows:

- disconnect both connectors, working in two stages:
  A) turn the metal hook upwards to release the connection;
  B) move the connector away;
- undo the bolts fixing the control unit and remove it.

When refitting the connector, proceed as follows:

- place the connector in contact with the control unit;
- rotate the metal hook until it is completely closed.

**NOE** *If replacing the engine control unit, connect the diagnostic equipment (Examiner) to the diagnostic socket and carry out the self-learning procedure for the engine idle adjustment actuator (M.D.S.), as described in the "BUTTERFLY CASING" paragraph.*

## LAMBDA SENSOR

### Removing - refitting

Disconnect the electrical connection (1) and remove the sensor (2) from the housing on the exhaust manifold.
When refitting, apply lubricating grease, resistant to high temperatures, to the thread.

## ENGINE RPM AND TDC SENSOR

### Removing-refitting

Disconnect the electrical connection.
Undo the fixing bolt and remove the senor.

### Checking the gap

Check the distance between the sensor and the flywheel teeth (gap).

**Gap: 0.5 - 1.5 mm**

**NOTE** *If necessary, work on the sensor support (e.g. if the gap is outside of the tolerance, the sensor is not aligned, etc.); the procedure for correctly positioning the sensor and support and the timing should be carried out following the instructions given in the engine overhaul manual.*



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## HITACHI INTEGRATED INJECTION/IGNITION SYSTEM

### INTRODUCTION

The Hitachi system fitted on the Marea-Marea Weekend versions with the 1747 i.e. 16v engine belongs to the category of static advance, digital electronic ignitino systems integrated with phased, multiple, intermittent type electronic fuel injection systems.
The system can be divided into the following sub-systems:

ELECTRICAL/ELECTRONIC CIRCUIT
AIR INTAKE CIRCUIT
FUEL SUPPLY CIRCUIT
EMISSION CONTROL DEVICES

The system is capable of detecting the following parameters via special sensors:

1. the engine rotation speed;
2. the position of each pair of cylinders in relation to TDC for cylinder 1;
3. the engine intake air flow rate;
4. the position and variation speed of the position of the accelerator butterfly;
5. the temperature of the engine coolant;
6. the effecive mixture strength (through the Lambda sensor signal);
7. the possible presence of detonation;
8. the speed of the vehicle;
9. the battery voltage;
10. whether or not the climate control compressor is switched on.

This information, usually in analogue format, is converted into digital signals by the analogue/digital converters (A/D) for use by the control unit.
In particular, any engine operating point is identified by two parameters:

- the engine rotation speed, measured in revs per minute (rpm);
- the engine load, which consists of the quantity of air drawn in by each cylinder.
- This quantity is calculated on the basis of the intake air flow rate and is represented by the parameter TP, measured in milliseconds (ms).

The control unit memory contains the management programme (software) which consists of a series of strategies, each of which manages a precise system control function.
By using the information (input) listed previously, each strategy processes a series of parameters, using the data maps stored in special areas of the control unit memory, and then controls the system actuators (output), which are the devices which allow the engine to operate, namely:

1. injectors;
2. ignition coils;
3. various type solenoid valves;
4. fuel pump;
5. relays.

**NOTE** *The HITACHI injection/ignition system does not require any adjustments as it is the self-adjusting and self-adapting type.*

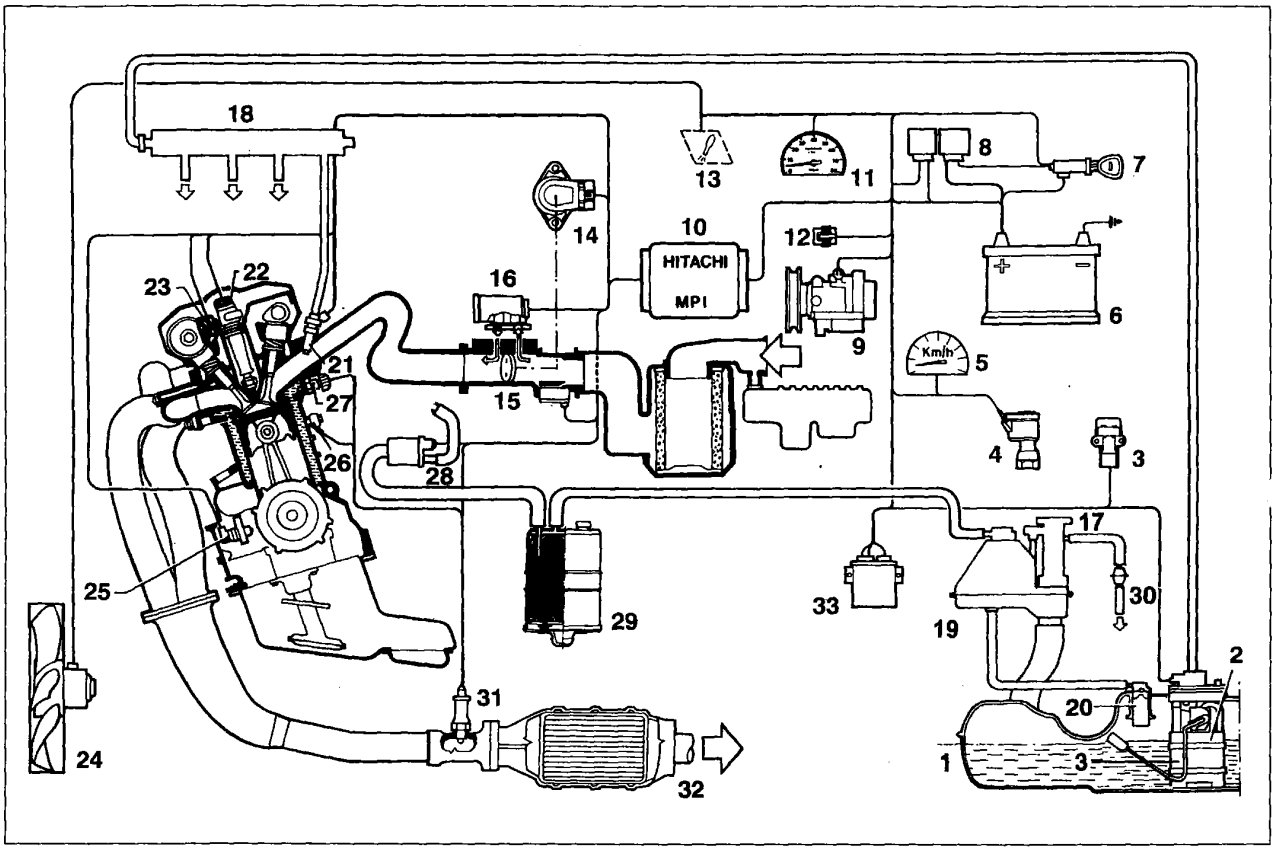
**NOTE** *The numbers in the boxes in the drawings and the wiring diagrams denote the corresponding HITACHI engine management control unit pins (a number followed by A, indicates connector A, a number followed by B, indicates connector B).*

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## FUNCTIONAL DIAGRAM SHOWING INJECTION/IGNITION SYSTEM



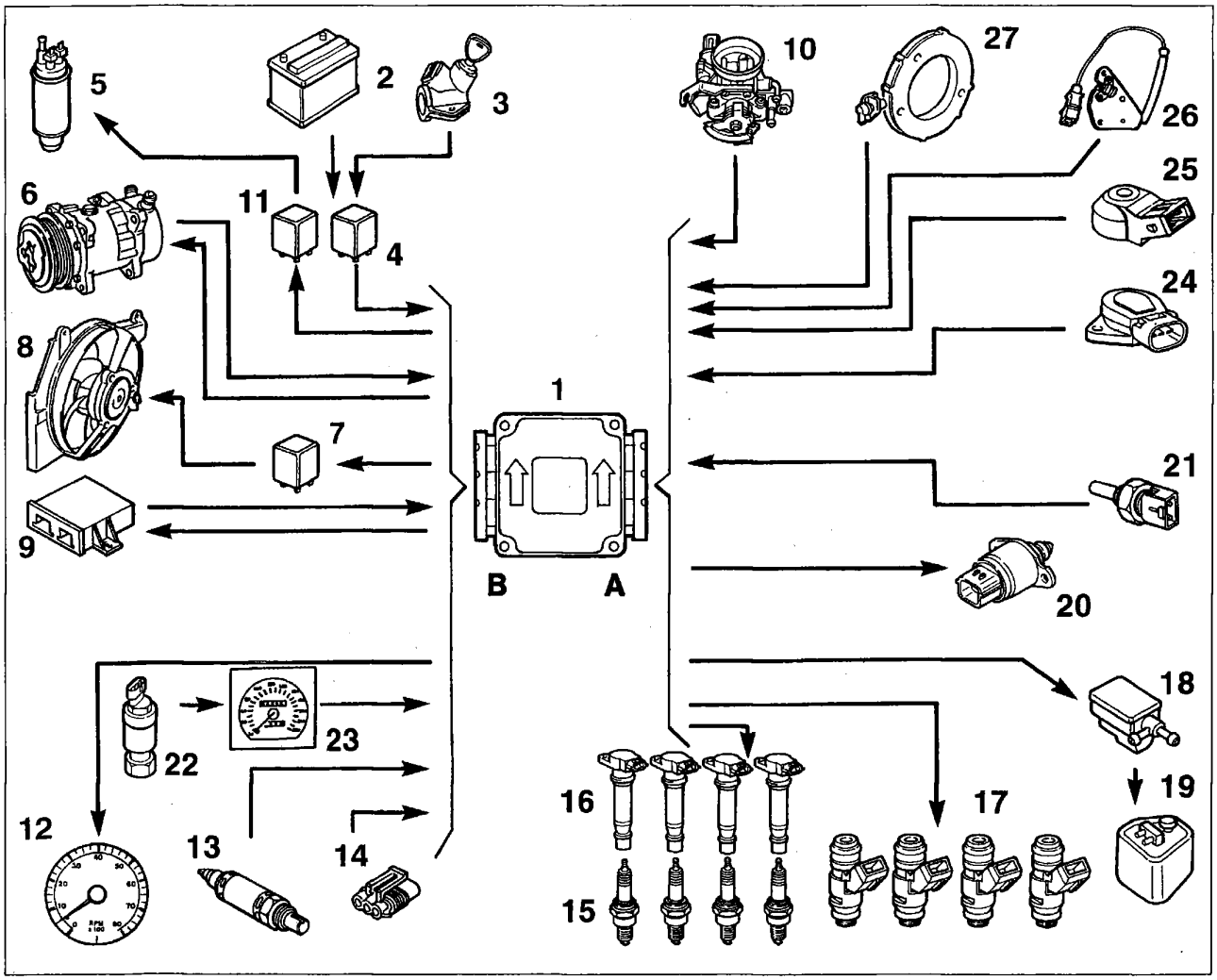

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1. Fuel tank
2. Drip tray including: electric fuel pump, pressure regulator, filter, gauge
3. Inertia switch
4. Vehicle speed sensor
5. Speedometer
6. Battery
7. Ignition key
8. I.E. system relays
9. Climate control compressor
10. HITACHI engine management control unit
11. Rev counter
12. Diagnostic equipment connector
13. System failure light
14. Butterfly position sensor
15. Butterfly casing with air flow meter incorporated
16. Engine idle adjustment actuator
17. Filler cap with safety valve
18. Fuel manifold
19. Fuel vapour separator
20. Overturn valve
21. Injector
22. Coil
23. Engine timing sensor
24. Radiator fan
25. Engine rpm sensor
26. Detonation sensor
27. Coolant temperature sensor
28. Charcoal filter solenoid valve
29. Charcoal filter
30. Safety and ventilation valve
31. Lambda probe
32. Catalytic silencer
33. FIAT CODE control unit



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## DIAGRAM SHOWING INFORMATION ENTERING/LEAVING HITACHI INJECTION/IGNITION SYSTEM CONTROL UNIT AND SENSORS/ACTUATORS




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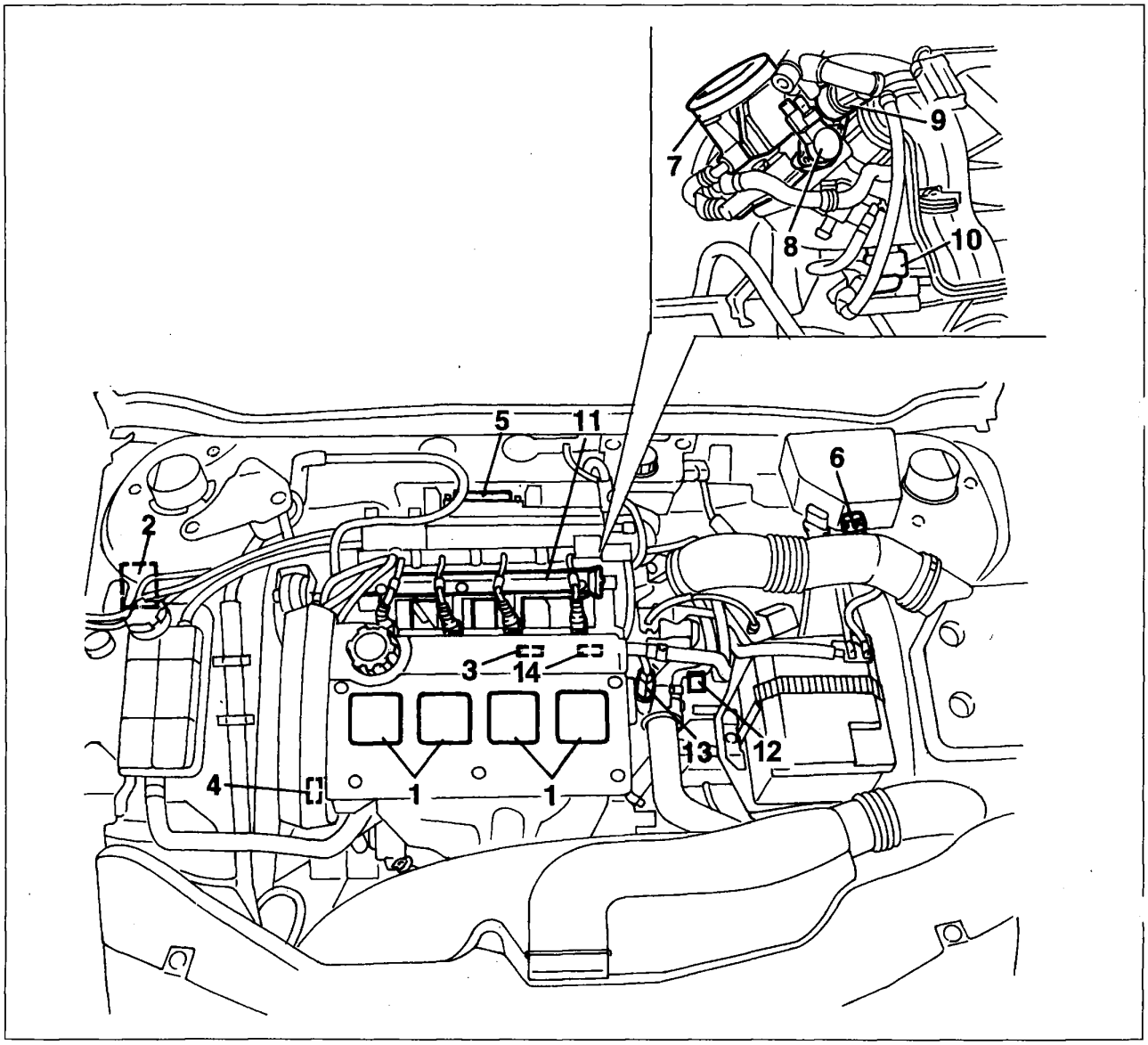
1. **HITACHI** engine management control unit
2. Battery
3. Ignition switch
4. System relay
5. Electric fuel pump
6. Climate control system
7. Radiator fan relay
8. Radiator fan
9. **FIAT**-CODE control unit
10. Air flow meter
11. Fuel pump relay
12. Rev counter
13. Lambda probe
14. Diagnostic equipment connector
15. Spark plugs
16. Coils
17. Injectors
18. Charcoal filter solenoid valve
19. Charcoal filter
20. Idle speed adjustment stepping motor
21. Coolant temperature sensor
22. Vehicle speed sensor
23. Speedometer
24. Butterfly position sensor
25. Detonation sensor
26. Engine timing sensor
27. Engine rpm sensor



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# 10

## LOCATION OF HITACHI INJECTION/IGNITION SYSTEM COMPONENTS IN ENGINE COMPARTMENT




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1. Ignition coils
2. Charcoal filter
3. Detonation sensor
4. Engine timing sensor
5. Hitachi engine management control unit
6. Diagnostic socket
7. Butterfly casing with air flow meter
8. Butterfly valve position sensor
9. Idle speed adjustment actuator
10. Charcoal filter solenoid valve
11. Fuel manifold with injectors
12. Vehicle speed sensor
13. Coolant temperature sensor
14. Engine rpm sensor



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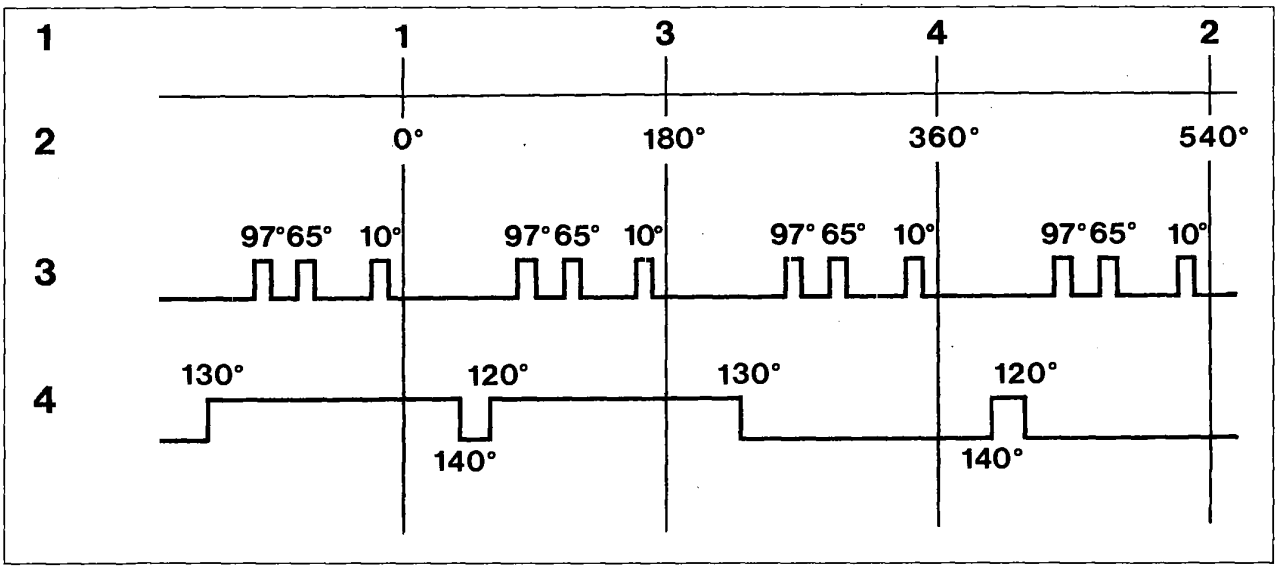
## SYSTEM MANAGEMENT STRATEGIES

### MANAGEMENT OF THE SIGNALS

During starting, the control unit recognizes the phasing of the injection and the ignition which are vital for the subsequent operation of all strategies.
This recognition is based on interpreting the succession of signals coming from the flywheel sensor, on the crankshaft and the engine timing sensor, on the camshaft.

**NOTE** *The term "square signals" refers to the collection of signals coming from the sensor on the crankshaft and those from the sensor on the camshaft which, due to the precise reciprocal position, provide the control unti with a synchronized sequence of signals which the control unit is capable of recognizing.*

These signals are composed as follows:
- flywheel on the crankshaft: it has two symmetriacl sets of teeth, arranged respectively at 10°, 65° and 97° in advance of each TDC;
- wheel on the camshaft: it has two long inspection windows and a short one, whose size and position allow the signal to be supplied as illustrated.




4F004OJ01

1. cylinder TDC
2. Crankshaft angles
3. Crankshaft flywheel signal (engine rpm sensor)
4. Camshaft wheel signal (engine timing sensor)

**NOTE** *The numbers relating to the signals indicate the crankshaft angles in advance of the next TDC.*



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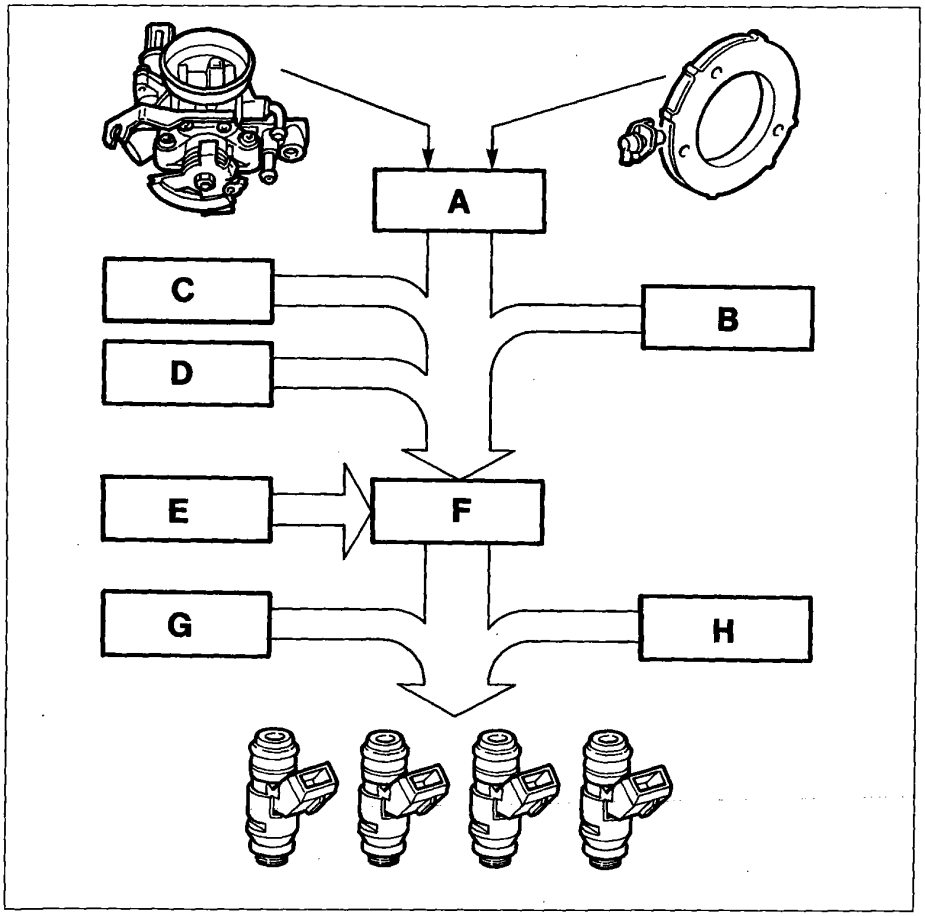
# 10.

## MANAGEMENT OF THE INJECTION

The injection management strategies are designed to provide the engine with the correct amount of fuel at the desired time according to the engine operating conditions.

**NOTE** *The presence of the flow meter allows the intake air mass to be measured directly making the presence of the intake air temperature sensor superfluous.*

The management of the injection basically consists of calculating the injection time, determining and then implementing the injection timing via the operation of the injector.
The "basic" injection time depends on the specifications of the injector and corresponds to the quantity of fuel to be injected into each cylinder. The latter is, in turn, determined by multiplying the quantity of air drawn in by each cylinder (calculated according to the quantity of intake air and the engine rotation speed) by the desired mixture strength for the engine operating point.
The final injection time is determined by means of a calculation algorhythm in which the "basic" time is corrected by a series of coefficients which take into account the different engine operating conditions which are highlighted by the various sensors in the system.




4F0050J01

A: "basic" injection time
B: correction coefficients:
- low engine temperature
- high engine temperature
- starting and post-starting
- butterfly fully open
- deceleration
- acceleration

C: feed-back mixture control
D: self-adjustment
E: cut-off
F: intermediate injection time
G: extra-pulse
H: non phased injection management



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Control of the mixture strength (feed-back control)

**NOTE** *The mixture strength is defined by the following ratio and is denoted by the greek letter α (alfa):*

$$\frac{\text{quantity of air drawn in by the engine}}{\text{quantity of fuel injected}}$$

*The stoichiometric ratio is defined by the following ratio and is denoted by α st:*

$$\frac{\text{theoretical quantity of air required to burn all the fuel njected}}{\text{quantity of fuel injected}}$$

*The following ratio defines the mixture strength which is denoted by the greek letter λ (lambda):*

$$\frac{\text{quantity of air drawn in by the engine}}{\text{theoretical quantity of air required to burn all the fuel injected}}$$

Consequently $\alpha / \alpha st = \lambda$.
The stoichiometric ratio depends on the type of fuel: for current unleaded petrol this value is around 14.7 - 14.8 which corresponds to a Lambda of 1.
A mixture is spoken of as being *rich* () when the quantity of air is lower than that in the stoichiometric ratio and in this case the Lambda < 1:
a mixture is described as *poor* (*or lean*) when the quantity of air is greater than that in the stoichiometric ratio and in this case the Lambda > 1.

The strategy is designed to correct the "basic" injection times so that the mixture strength continuously fluctuates at high frequency between 0.98 and 1.02.
The fluctuation frequency varies according to the engine load and speed: it is in the order of tens of Hertz.

**NOTE** *1 Hz = 1 fluctuation per second*

In the following conditions:

- cut-off,
- butterfly opening above 70° and high engine load,
- engine temperature below 25°C,

the strategy is disabled.

### Self-adjustment

The control unit is equipped with a self-adjustment function which has the task of memorizing any possible differences between the basic map and the corrections imposed by the Lambda sensor which may take place during operation. These differences (due to the ageing of the system and engine components) are permanently memorized, allowing the operation of the system to be adapted to the gradual alterations in the engine and the components compared with when they were new.
The strategy is disabled whilst the charcoal filter solenoid valve is open.
If the control unit is replaced, the vehicle must be road tested allowing the engine to reach operating temperature and the control unit self-adjustment function to intervene (especially during idling stops).

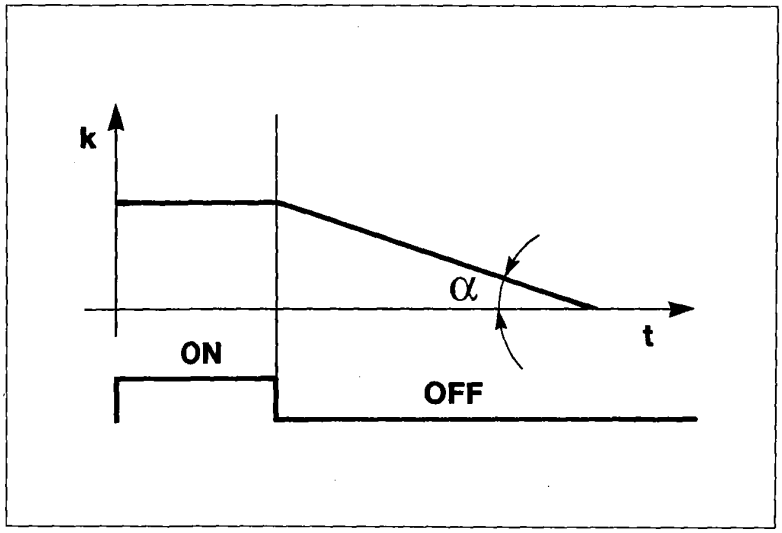
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# 10.

## Starting and post-starting

During starting, the engine timing cannot be recognized therefore the phased injection cannot be implemented.
Whilst the engine is first running, an initial simultaneous injection is carried out (also because the considerable fluctuations in the rotation speed do not allow the injection timing to be calculated correctly) and later on the injection becomes the phased type.
The "basic" injection time is increased by a multiplication coefficient for the entire time the engine is driven by the starter motor.
Once the engine is started up, the coefficient is gradually reduced until it disappears after a certain length of time, the lower the temperature of the engine, the longer this time.



4F007OJ01

K: enrichment coefficient
t: time
α: engine temperature function decrease
ON: engine driven (crank)
OFF: engine started (run)

## Operation when cold

Under these circumstances the mixture is naturally weakened as a result of the reduced evaporation and strong condensation of the fuel on the inner walls of the intake manifold: in addition, the increased viscosity of the lubricant oil causes an increase in the passive resistance of the engine.
The "basic" injection time is corrected by a multiplication coefficient which depends on the temperature and speed of the engine.

## Operation in full load conditions

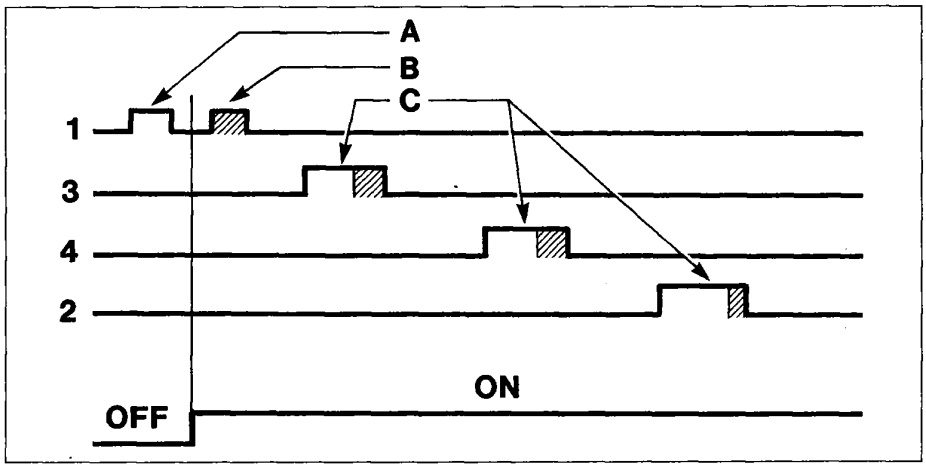
The strategy is enabled when the butterfly opening exceeds 70°.
The "basic" injection time is multiplied by a coefficient (function of the engine speed) equal to about 1.1.



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### Operation in acceleration conditions

During this stage, the control unit increases the quantity of fuel supplied.
The "basic" injection time is multiplied by a coefficient which depends on the temperature of the engine and the opening speed of the accelerator butterfly (average vaule 1.2).
If the sharp variation in the injection time is calculated when the injector is already closed, the control unit reopens the injector (extra pulse) to compensate the mixture strength as quickly as possible: the subsequent injection are, however, already increased according to the previously mentioned coefficients.




4F008OJ01

A: normal injection time
B: extra-pulse
C: injection time including enrichment
OFF: engine at stationary speed
ON: engine in transition

### Operation in deceleration conditions

During this stage a negative transition strategy is implemented to decrease the quantity of fuel supplied: the "basic" injection time is multiplied by a coefficient which depends on the temperature of the engine and the engine speed and load conditions in the moment immediately preceding the start of the deceleration.

### Operation in cut-off conditions

The cut-off strategy is implemented when the control unit recognizes that the butterfly is in the idle position (signal from the butterfly potentiometer) and the engine speed is above 1600 rpm (with the engine warm).
The supply to the engine is re-enabled when the butterfly is recognized not to be in the closed position or when the engine speed goes below 1200 rpm (with the engine warm).

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### Rotation speed limiter

This strategy limits the maximum speed which can be reached by the engine, gradually enabling the cut-off, as illustrated in the table.
Maximum speed: 7150 rpm

| Cylinders / mode | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 1 cylinder | O | | | |
| 2 cylinders | O | | | O |
| 3 cylinders | O | | O | O |
| 4 cylinders | O | O | O | o |

### Fuel pump operation

The fuel pump is operated by the engine management control unit via a relay.
The pump cuts out:
- if the engine speed goes below 50 rpm;
- after a certain length of time (about 5 seconds) if the ignition is switched ON and the engine is not started up (timed go ahead);
- if the inertia switch has been operated.

### Operation of the injectors

The operation of the injectors is the phased, sequential type. However, during starting the injectors are operated once initially in parallel.
The phasing of the injector operation varies according to the engine speed.

## MANAGEMENT OF THE FIAT·CODE ANTI-THEFT FUNCTION

The system is equipped with an anti-theft function. This function is achieved thanks to the presence of a specific (FIAT CODE) control unit capable of dialogue with the engine management control unit and an electronic key with a special transmitter for sending a recognition code.
Each time the key is switched OFF, the FIAT CODE system completely deactivates the engine management control unit.
When the key is turned to the ON position, the following operations take place, in order:
1. the engine management control unit (whose memory contains a secret code) sends the FIAT CODE control unit a request to send the secret code for deactivating the immobilizer function;
2. the FIAT CODE control unit responds by only sending the secret code after having, in turn, received the recognition code transmitted by the ignition key;
3. the recognition of the secret code allows the deactivation of the immobilizer function for the engine management control unit and normal operation can be resumed.

NOTE *The presence of the FIAT CODE anti-theft system means that it is not advisable to use another engine management control unit during fault diagnosis. In such a case, the FIAT CODE control unit would transfer the (unrecognized) code to the test control unit which could then no longer be used on any other vehicle.*

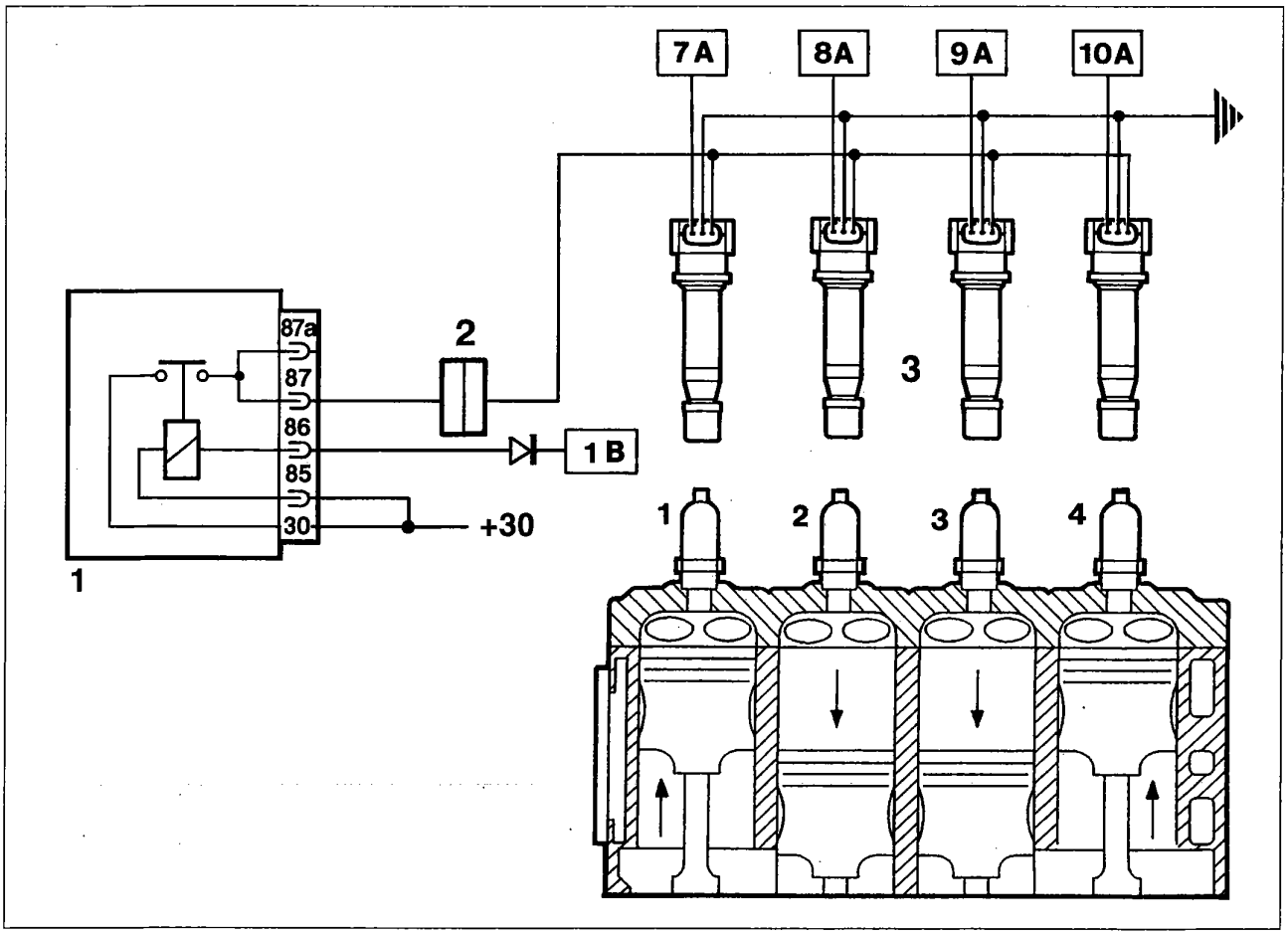


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## MANAGMENT OF THE IGNITION

The ignition management strategies are designed to strike the spark with the desired advance according to the engine operating conditions.

The management of the ignition basically consists of determining the ignition advance and implementing it through the operation of the power transistor incorporated in each coil.
The "basic" advance value, calculated according to the intake air flow rate and the engine speed, is then corrected on the basis of the different engine operating conditions.
The control unit determines the moment of the start of the conduction of the current in the coil primary winding according to the engine rotation speed.
The angle of this moment obviously varies, in relation to TDC for the explosion stroke of each cylinder and, the greater the engine rotation speed, the greater the advance, because the (dwell) time required to saturate the current in the coil primary winding is more or less constant.
The moment of the start of conduction is corrected according to the battery voltage.

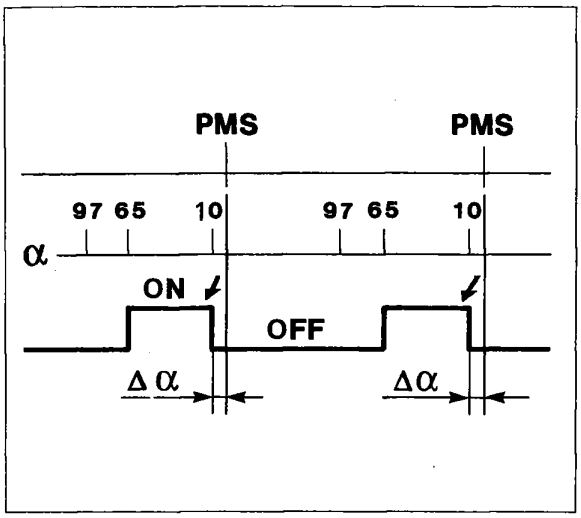



4F0100J01

1. System relay
2. Interface connector
3. Single ignition coil (pencil-coil)



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α: crankshaft flywheel signals
Δα: fixed ignition advance (10° engine)
ON: coil conduction activated
OFF: coil conduction deactivated

### Starting

During starting, the normal management of the advance cannot be carried out because the considerable fluctuations in the rotation speed do not allow the dwell and the advance to be calculated correctly.
The advance is therefore managed taking the following references:
- for the start of conduction, the tooth at 65°;
- for the ignition advance, the tooth at 10°.

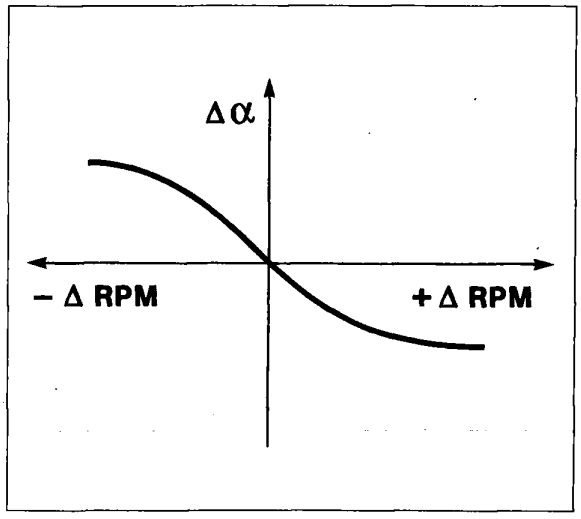
There is a fixed advance of 10° for the entire time the engine is driven by the starter motor.

### Operation when cold

Whilst the engine is running when cold, an additional advance correction is implemented: the increase in the advance in relation to the value in the map is inversely proporational to the temperature of the engine.

### Operation in cut-off conditions

The ignition advance is increased on entry into cut-off: from the moment the supply of fuel is restored, the advance is gradually returned to the "basic" value.




Δα: correction of idle ignition advance
+Δ RPM: the idle speed is higher than the nominal speed
-Δ RPM: the idle speed is below the nominal speed

### Operation with engine idling

When the engine is idling, the management of the advance is implemented independently of the "basic" advance.
The idle advance value, which varies according to the temperature of the coolant (10° with the engine warm) is corrected according to the variation in the speed in relation to a pre-set speed, also dependent on the temperature.
The advance is increased if the speed decreases and is reduced if the speed decreases in order to guarantee the stability of the actual speed.



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## Control of detonation

This strategy has the task of detecting the presence of detonation by processing the signal coming from the appropriate sensor. The strategy continuously compares the signal coming from the sensor with a level which is, in turn, constantly updated to take into account background noise and the ageing of the engine.
If the system recognizes the presence of detonation, the strategy reduces the ignition advance, in steps of 2° up to a maximum of 7°, until the phenomenon disappears. Later, the advance is gradually restored to the basic value or until the onset of the phenomenon again. The advance increases are implemented gradually, whilst the reductions are implemented immediately.
In acceleration conditions, the strategy uses a higher threshold to take into account the increased noise of the engine under these circumstances.
The strategy is also equipped with a self-adjustment function which temporarily memorizes the reductions in the advance which are continuously repeated in order to adapt the advance to the different conditions in which the engine finds itsellIf (for example, the use of a low octane rating fuel). The strategy is capable of restoring the advance to the map vaule if the conditions which caused the reduction no longer exist.

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# 10.

## MANAGEMENT OF THE ENGINE IDLE

The general aim of this strategy is to keep the engine speed around the value memorized (engine warm: 850 rpm): the position assumed by the actuator depends on the speed of the engine and the speed of the vehicle.

### Starting stage

When the key is inserted, the position assumed by the actuator depends on the temperature of the engine and the voltage of the battery (open-loop position).

### Engine started with accelerator pedal released

The engine speed varies according to the temperature of the engine and is constantly kept close to this value by altering the position of the shutter in order to compensate for any fluctuations in the speed.
This especially takes place when external loads are switched on (power assisted steering, heated rear windscreen, etc.).
If the air conditioning and the fans are switched on, both managed by the control unit, the strategy manages the actuator in advance of the switching on.

### Normal driving

In these conditions the actuator is in the open-loop position.

### In deceleration conditions

In deceleration conditions outside of idling, the control unit controls the position of the actuator by means of a special flow rate curve (dash-pot curve), in other words it slows down the return of the shutter to its housing, reducing the braking effect of the engine.

## MANAGEMENT OF THE CHARCOAL FILTER

This strategy controls the position of the charcoal filter solenoid valve as follows:
- during starting, the solenoid valve remains closed, preventing the fuel vapours from enriching the mixture; this condition persists until the engine coolant reaches 25°C;
- with the engine at operating temperature, the control unit operates the solenoid valve in duty-cycle in order to control the quantity of fuel vapours sent to the intake, according to the engine speed and load conditions.

In the following operating conditions:
- butterfly in closed position,
- engine speed below 1250 rpm,
- engine load below a pre-set level

the operation of the solenoid valve is disabled, keeping it in the closed position.



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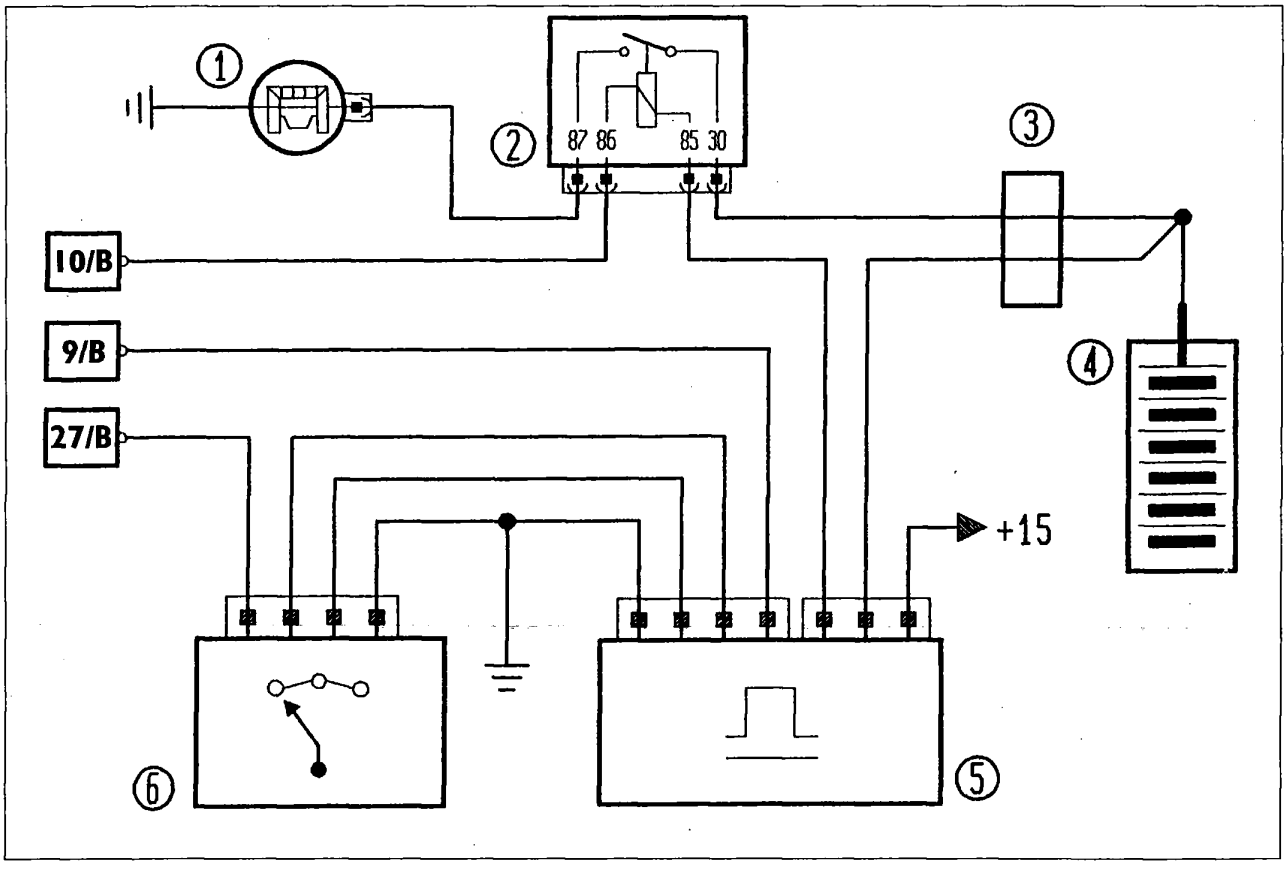
## MANAGEMENT OF THE CLIMATE CONTROL SYSTEM

The Hitachi engine management control unit is functionally connected to the climate control system in as far as:
1. it receives the request to switch on the compressor via pin 9/B and operates the interventions (additional air);
2. it gives the go ahead to switch on the compressor via pin 10/B when the strategy conditions are verified;
3. it receives information concerning the state of the three stage pressure switch from pin 27/B and operates the interventions (radiator fan operation).

As far as point 1 is concerned, if the engine is idling, the control unit increases the air flow rate passing from the idle actuator in advance of the compressor being switched on and, conversely, it returns the actuator to its normal position after the compressor is switched off.
As far, on the other hand, as point 2 is concerned, the control unit automatically switches off the compressor:

- for 6 sees (timed disengagement):
  - in butterfly opening conditions above 70°,
  - during vehicle take-off;

- as long as the critical conditions persist:
  - at engine coolant temperatures above 114°C,
  - at engine speeds below 750 rpm.




4F014OJ01

1. Compressor
2. Compressor relay feed
3. Fuse box
4. Battery
5. Climate control unit
6. Three stage pressure switch



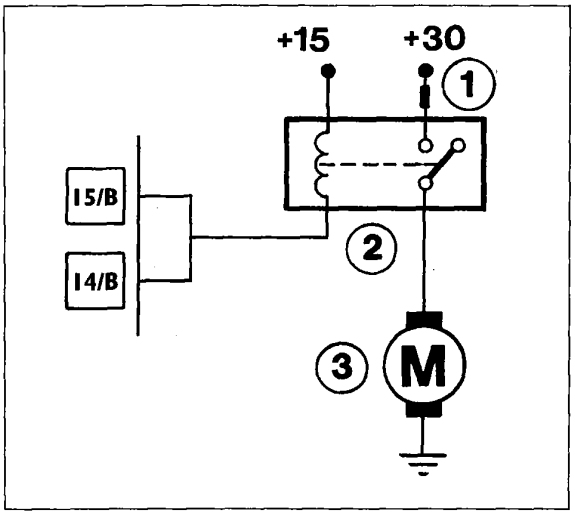
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# 10.

## MANAGEMENT OF THE RADIATOR FANS

The control unit directly controls the operation of the radiator fans according to the temperature of the engine coolant and whether or not there is a climate control system.

**NOTE** *Since the temperature of the engine is detected by the appropriate sensor, there is no longer a thermal contact on the radiator.*

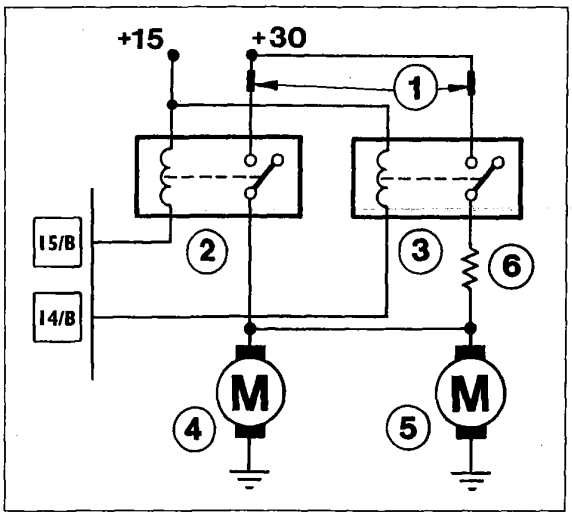



4F015OJ01

### Version without climate control

There is a single fan which comes on when the temperature of the coolant exceeds 95°C.
The fan is switched off with a hysteresis of 2°C at the temperature level.

1. Fuse
2. Fan relay
3. Fan




4F015OJ02

### Version with climate control

There are two fans: one low speed one and one high speed one.

**NOTE** *If this high speed fan comes on then the low speed fan comes on at the same time.*

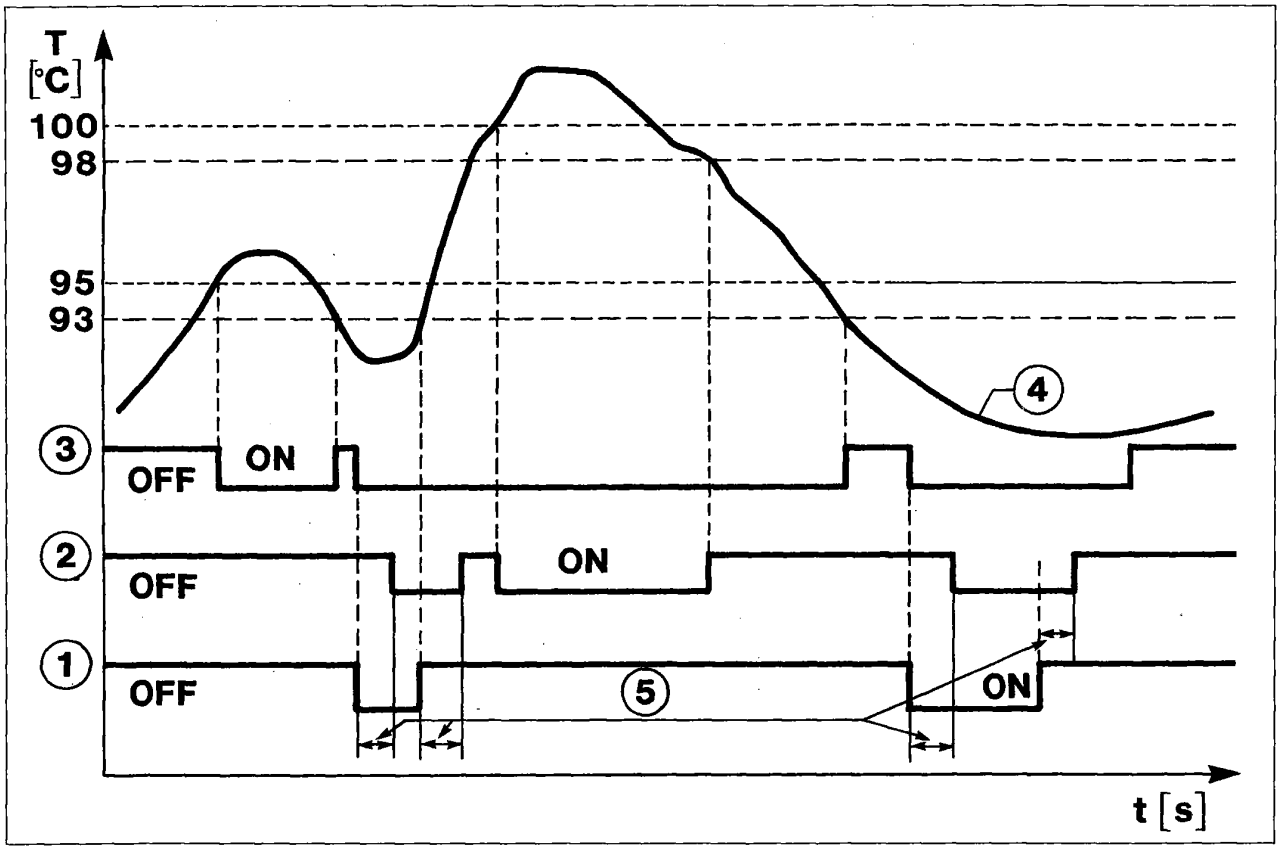
1. Fuse
2. High speed fan relay
3. Low speed fan relay
4. High speed fan
5. Low speed fan
6. Load resistance



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Diagram showing engagement of fans for version with air conditioning

Low speed fan: it comes on when the temperature of the coolant reaches 95°C.
High speed fan: it comes on when the temperature of the coolant reaches 100°C: the first fan is only switched off after the second one.
The engagement of the fans also depends on the state of the climate control system three stage pressure switch which determines the switching on of the first fan and then, with a certain delay, that of the second and the subsequent switching off.




4F016OJ01

1. Condition of three stage pressure switch
2. Condition of high speed fan
3. Condition of low speed fan
4. Engine coolant temperature progress
5. Three stage pressure switch engagement/disenagement delay

ON: fan/pressure switch activated
OFF: fan/pressure switch deactivated



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# 10.

## DIAGNOSTICS

The system has an autodiagnostic function which is designed to check for any irregularities in the following components:

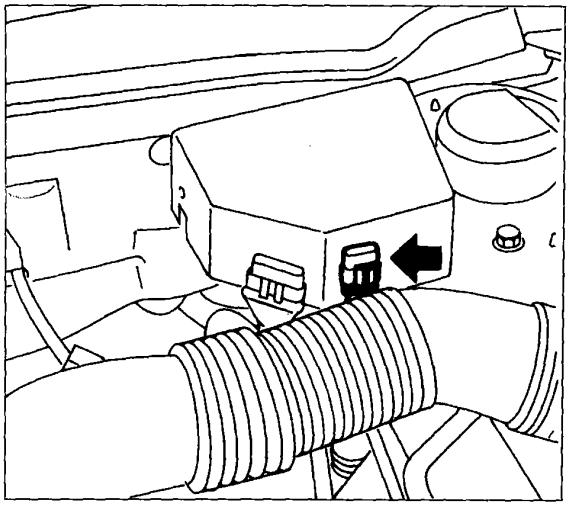
### Actuators

injectors
coils
charcoal filter solenoid valve
engine idle adjustment
stepping motor
fuel pump relay
climate control compressor relay

### Sensors

engine rpm sensor
engine timing sensor
air flow meter
Lambda sensor
coolant temperature sensor
detonation sensor
butterfly position sensor
vehicle speed sensor

### Location of diagnostic connector



P3N18GJ01

The detection of a fault, if confirmed, means that it is permanently memorized in addition to the relevant sensor being excluded from the system until it is repaired.
The detection of a confirmed fault usually involves, the warning light in the dashboard coming on; the light goes out when the fault conditions no longer exist.

**NOTE** *During starting, the light is:*
- *on for 1 second*
- *off for 0.1 seconds*
- *on for 0.5 seconds*
- *kept on/off definitively according to whether or not there are "permanent" errors present.*

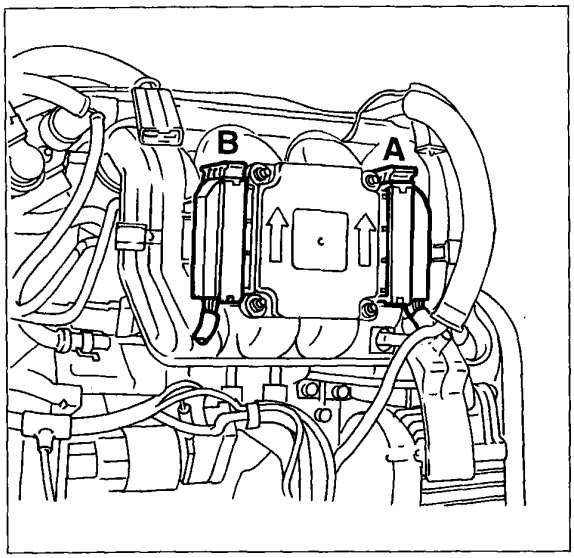
Working with the diagnostic equipment it is possible to carry out a complete fault diagnosis of the system, which consists of three stages:
display of a series of functional parameters (with the engine switched off or running);
display of the errors and their cancellation;
activation of some actuators (active diagnosis).

### Recovery strategy

If a failure is detected in the sensors/actuators, the control unit, where possible, replaces the missing data, reconstructing it using software (recovery) to allow the operation of the engine.



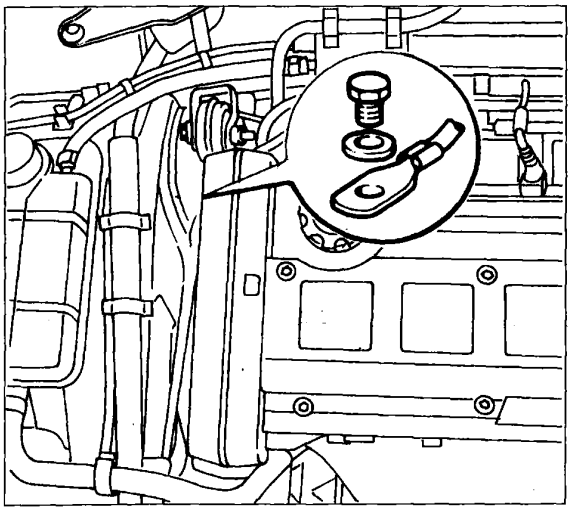
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4F018OJ01

*engine side wiring (A)*

butterfly position sensor
coolant temperature sensor
air flow meter
engine rpm sensor
engine timing sensor
vehicle speed sensor
detonation sensor
injectors
coils
idle speed stepping motor
charcoal filter solenoid valve



P3N19GJ02

## ELECTRICAL/ELECTRONIC CIRCUIT

### Wiring

The system has two distinct sets of wiring. The engine side wiring (A) connects the components fitted on the engine to the engine management control unit and the vehicle side wiring (B) which conects the other components to the control unit and acts an an interface with the vehicle wiring.

**NOTE** *The two connectors are the same, therefore if the control unit is dismantled the fitting position (arrow) must be followed to prevent them from being mixed up.*

*vehicle side wiring (B)*

electric fuel pump
twin relay
radiator fan relay
climate control compressor relay (if fitted)
fuses
Lambda sensor
diagnostic equipment
FIAT CODE control unti
instrument panel connection
supply from battery
supply from ignition switch

### Location of system earth points

In order to increase electro-magnetic compatibility and operational reliability, special care has been taken over the number and the location of the earth points, as illustrated below:
main earth directly on the battery negative;
engine control system earth on the timing side power unit mounting.

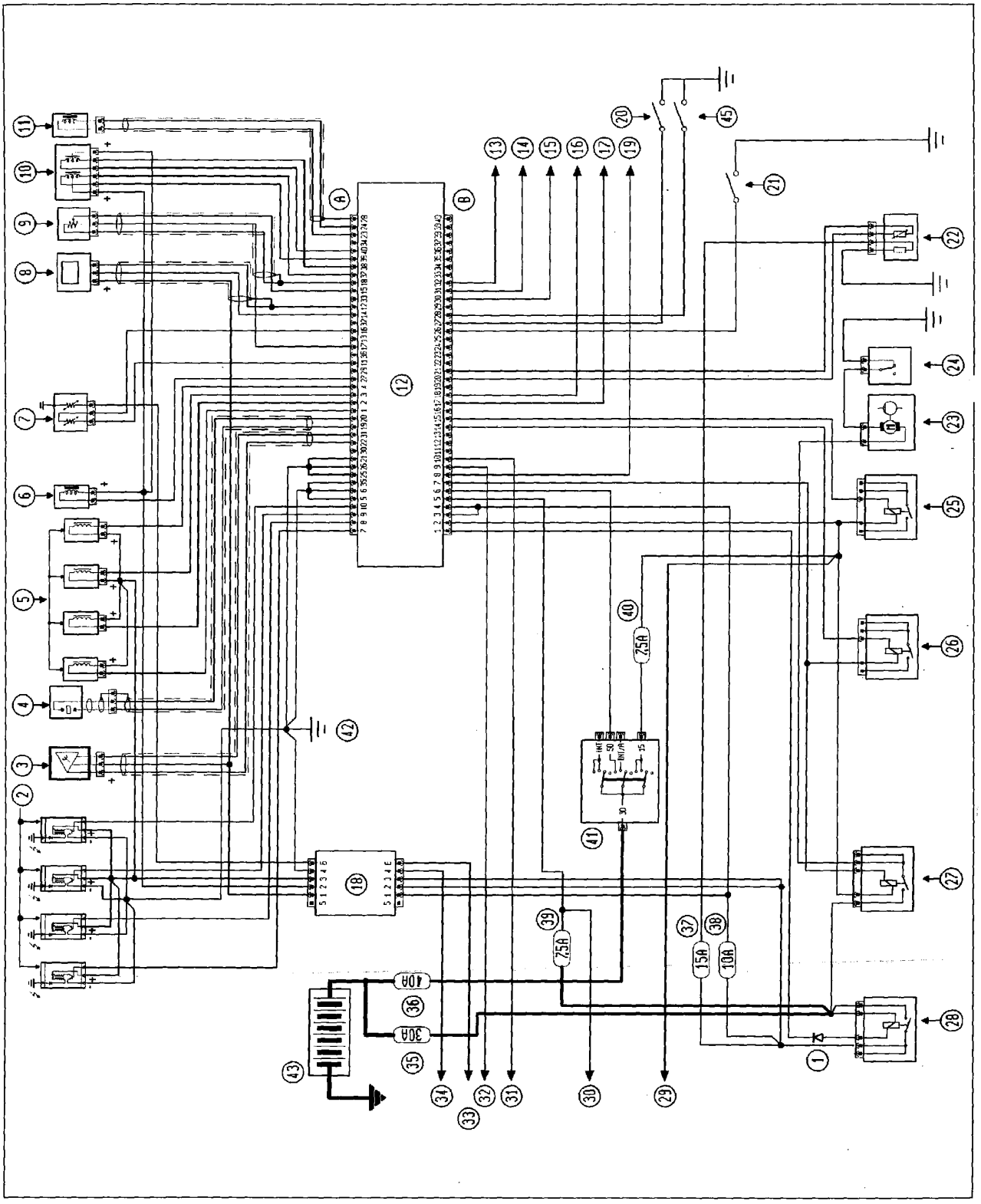
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# 10.

## HITACHI SYSTEM WIRING DIAGRAM




3N21GJ01



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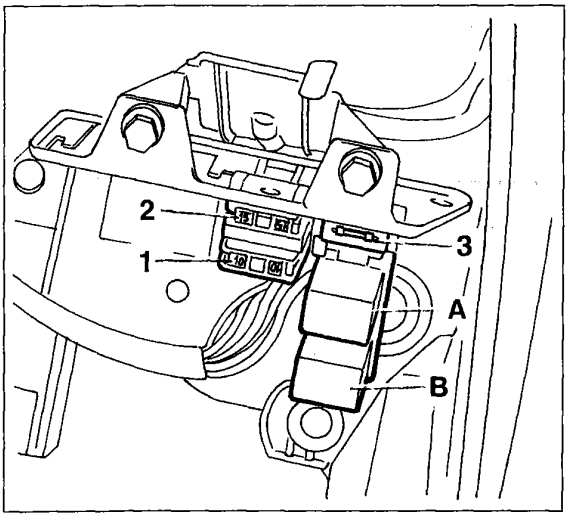
Hitachi system wiring diagram key

1. Anti-inversion diode
2. Single coils
3. Engine timing sensor
4. Detonation sensor
5. Injectors
6. Charcoal filter solenoid valve
7. Engine coolant temperature sensor
8. Air flow meter
9. Butterfly position sensor
10. Idle speed adjustment actuator
11. Engine rpm sensor
12. Engine management control unit
13. Line K
14. Memory reprogramming
15. FIAT CODE control unit connection
16. Vehicle speed intake
17. Rev counter operation
18. Interface connector
19. System failure light control
20. Intake from climate control three stage thermosta (if fitted)
21. Trim level selection (only connected to earth for versions without climae control)
22. Lambda probe
23. Electric fuel pump
24. Inertia switch
25. High speed fan relay feed (if fitted)
26. Low speed fan relay feed
27. Fuel pump relay
28. I.E. relay
29. Supply (+15) for FIAT CODE
30. Supply (+30) for FIAT CODE
31. Climate control compressor relay feed (if fitted)
32. Climate control compressor engagement intake (if fitted)
33. Engine coolant temperature gauge signal
34. Engine earth for FIAT CODE
35. Fuse A (30 A)
36. Fuse B (50 A)
37. Fuse C (15 A)
38. Fuse D (10 A)
39. Fuse E (7.5 A)
40. Fuse F (7.5 A)
41. Ignition switch
42. Engine earth
43. Battery
44. Intake from climate control 4 stage thermostat (if fitted)

## SYSTEM RELAYS

With the ignition key in the ON position (+15), the energizing coils for both relays are supplied and the power contacts are closed.
The relay (A) supplies the fuel pump, receiving voltage directly from the battery.
The relay (B) ensures the multiple supply of the control unit and the various system sensors and actuators both directly and through the connector blocks.

**NOTE** *The arrangement of the relays (A) and (B) and the fuses (1) and (2) can vary according to production requirements. The recognition depends on the electrical connections.*




4F021OJ02

A. Fuel pump relay

B. System relay

1. 10A fuse

2. 15A fuse

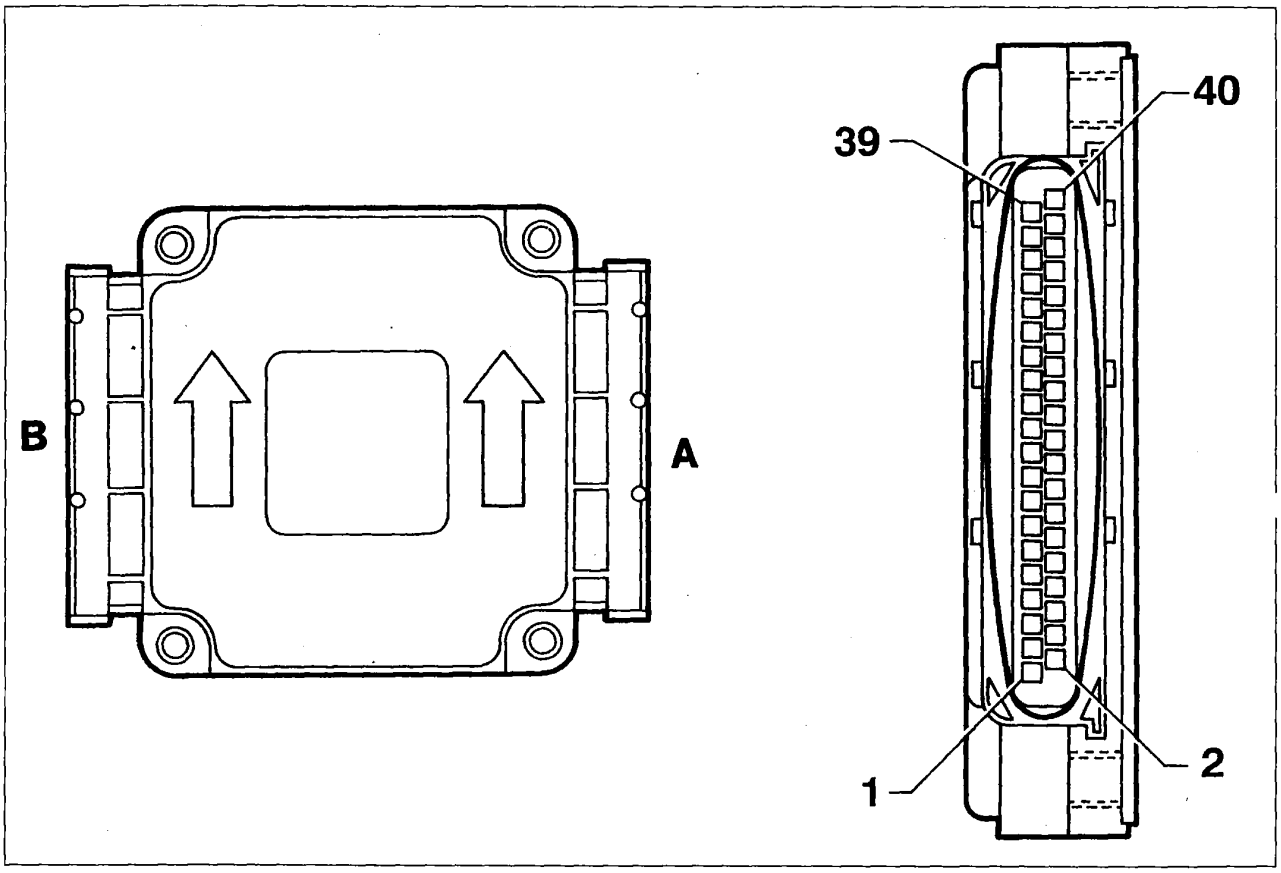
3. Anti-inversion diode



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# 10.

## HITACHI SYSTEM CONTROL UNIT PIN-OUT




4F020OJ01

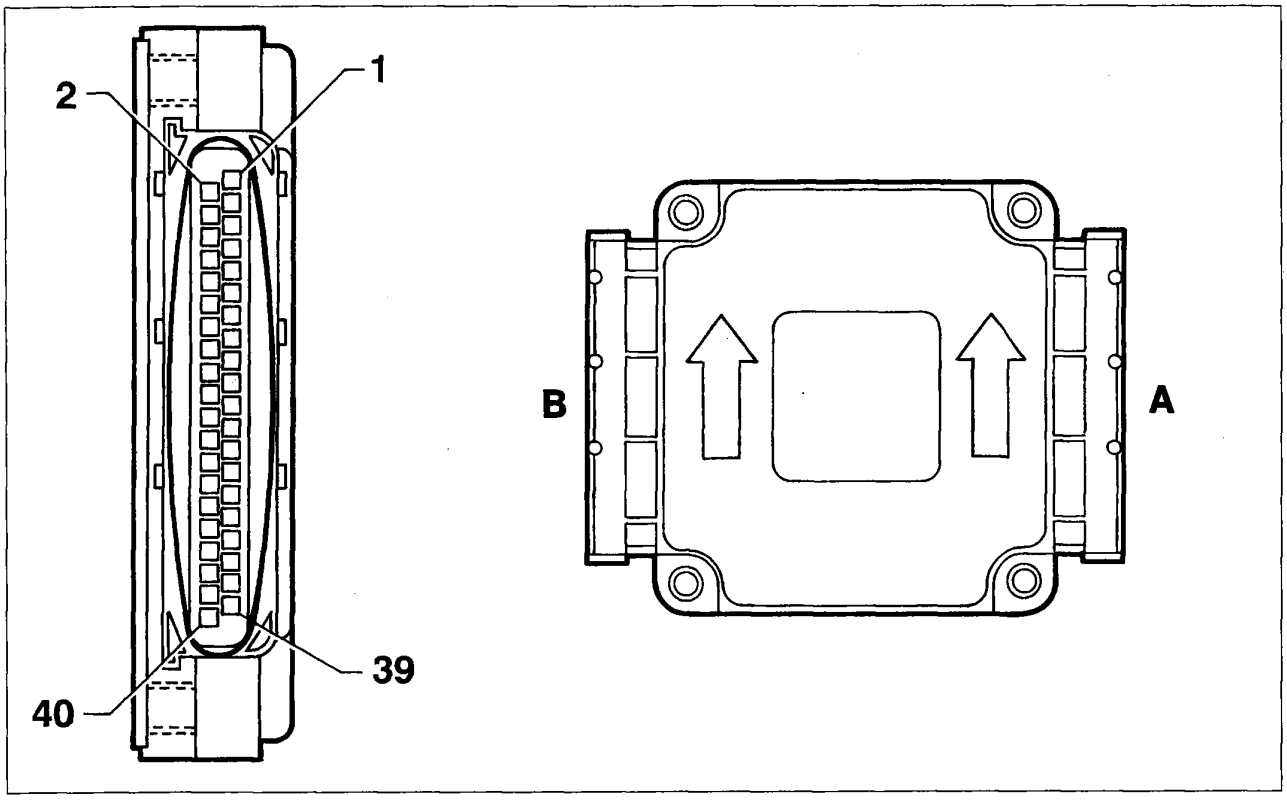
Connector A

1. Operation of injector for cylinder 1
2. Operation of injector for cylinder 2
3. Operation of injector for cylinder 3
4. Operation of injector for cylinder 4
5. Ignition earth
6. Power module (1)
7. Operation of coil for cylinder 1
8. Operation of coil for cylinder 2
9. Operation of coil for cylinder 3
10. Operation of coil for cylinder 4
11. Engine coolant temperature earth
12. Air flow meter earth
13. N.C.
14. Air flow meter signal
15. Butterfly position sensor signal
16. Coolant temperature sensor signal
17. Butterfly position sensor supply
18. Butterfly position signal earth
19. Detonation sensor signal
20. Detonation sensor earth
21. Container earth
22. Engine timing sensor signal
23. Engine rpm sensor positive
24. Engine rpm sensor negative
25. A/D converter earth
26. Coil earth
27. Charcoal filter solenoid valve operation
28. Engine rpm sensor screening
29. N.C.
30. N.C.
31. Engine timing sensor earth
32. N.C.
33. N.C.
34. N.C.
35. Power earth (2)
36. N.C.
37. Phase 1 idle speed actuator operation
38. Phase 2 idle speed actuator operation
39. Phase 3 idle speed actuator operation
40. Phase 4 idle speed actuator operation



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## HITACHI SYSTEM CONTROL UNIT PIN-OUT




4F021OJ01

Connector **B**

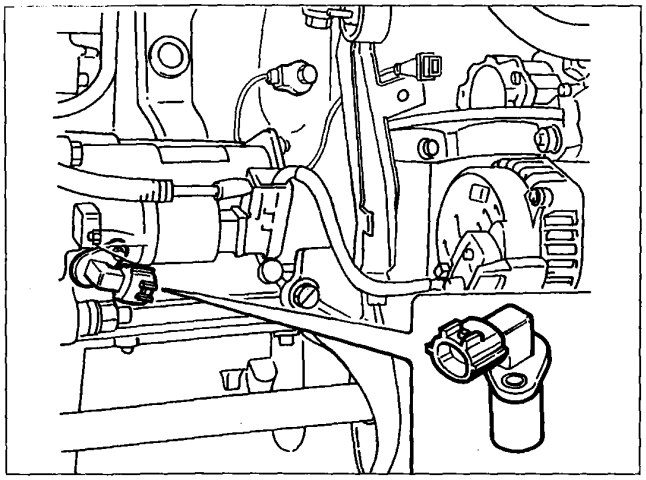
1. System relay operation
2. Control unit supply (+15)
3. Power supply 1
4. Power supply 2
5. Control unt supply (+30)
6. Engine started signal from ignitino key +50
7. Fuel pump relay operation
8. System failure light operation
9. Air conditioning compressor engagement signal (if fitted)
10. Air conditioning compressor relay operation (if fitted)
11. N.C.
12. N.C.
13. N.C.
14. Low speed fan relay operation
15. High speed fan relay operation
16. N.C.
17. Rev counter operation
18. Vehicle speed sensor signal
19. N.C
20. Lambda probe signal
21. Lambda sensor negative
22. N.C.
23. N.C.
24. N.C.
25. N.C.
26. Trim level selection (to earth only for versions without climate control)
27. Three stage thermostat signal (only for versions with climate control)
28. N.C.
29. N.C.
30. Connection with FIAT CODE
31. Reprogramming
32. Line K
33. N.C.
34. N.C.
35. N.C.
36. N.C.
37. N.C.
38. N.C.
39. N.C.
40. N.C.

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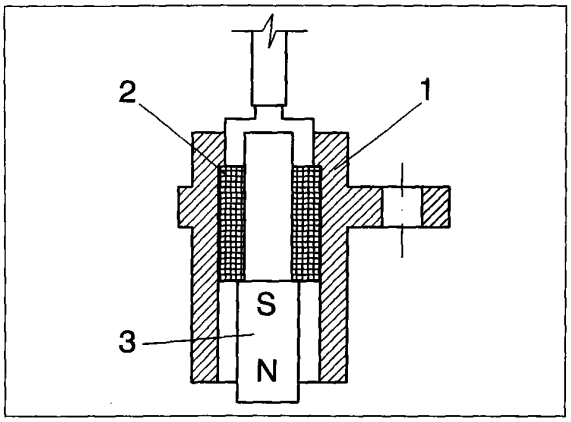
# 10.



3N26GJ01

## ENGINE RPM SENSOR

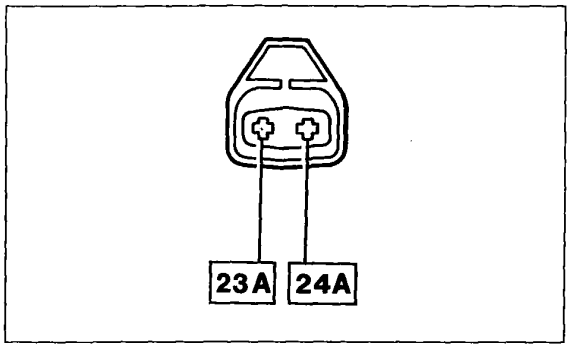
This sensor is fixed to the cylinder block/crankcase: the flywheel is in one piece with the crankshaft crank.




3N26GJ02

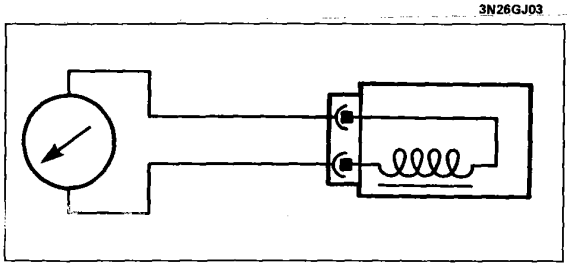
### Operating principle

The sensor consists of a tubular casing (1) which contains a permanent magnet (3) and an electrical winding (2):
As a result of the flywheel teething passing, the magnetic flow produced by the magnet (3) undergoes the fluctuations produced by the variation in the gap.
These fluctuations produce an electro-motive force in the winding (2) where there is an alternately positive voltage (tooth facing the sensor) and negative voltage (gap facing the sensor: see paragraph on "signal management"). The peak sensor output voltage value, all things being equal, depends on the distance between the sensor and the tooth (gap).




3N26GJ03

### Wiring connector



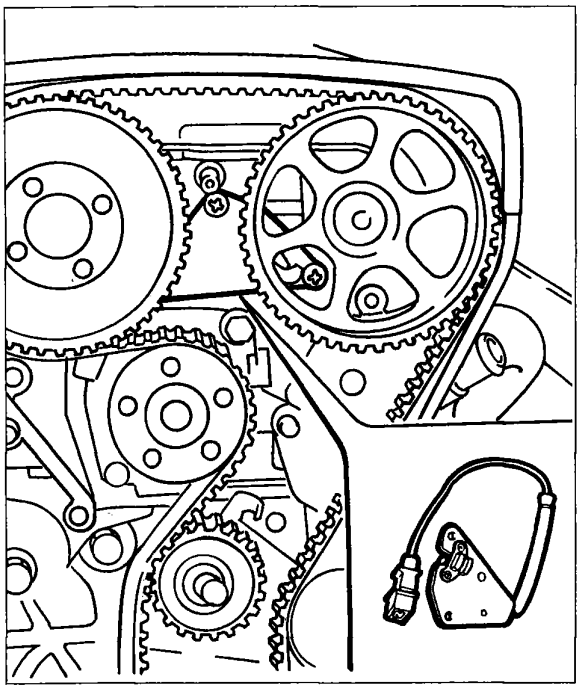
3N26GJ04

The sensor resistance can be measured by disconnecting the connector and connecting an ohmmeter to the sensor terminals

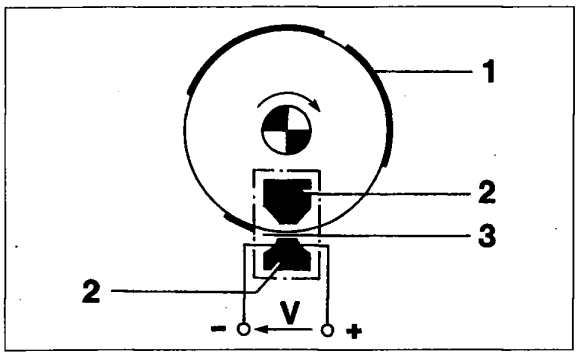
Resistance: **570±57 ohm at 20°C**



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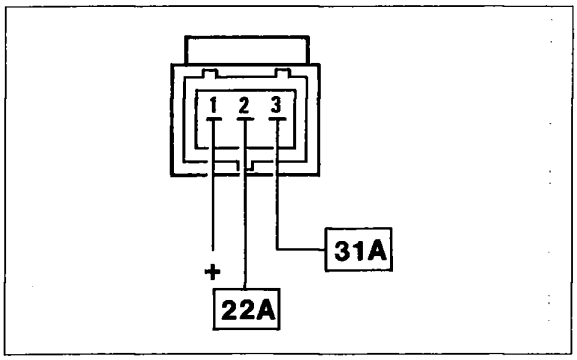
3N27GJ01




3N27GJ02

1. Deflector
2. Mangetic material
3. Gap

### Wiring connector




3N27GJ03

## ENGINE TIMING SENSOR

The engine timing signal, in conjunction with the engine rpm and TDC signal, allows the control unit to recognize the succession of cylinders to implement the phased injection.
This signal is produced by a Hall effect sensor, fitted by the exhaust camshaft drive pulley.

**NOTE** *It is not possible to carry out any adjustments to the angular position of the sensor.*

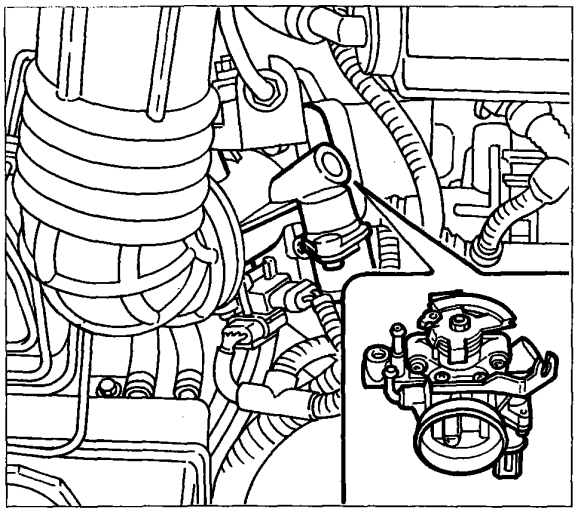
### Operating principle

A semi-conductor layer, through which the current passes, immersed in a normal magnetic field (lines of force perpendicular to the direction of the current) produces a difference in power, known as Hall voltage.
If the intensity of the current remains constant, then the voltage produced only depends on the intensity of the magnetic field. It is therefore simply necessary to alter the intensity of the field perodically in order to produce a modulated electrical signal.
In practice, to achieve this change, the sensor passes through a metal ring (fixed to the inner part of the timing pulley) which has a series of openings: as it moves, when the ring covers the sensor it blocks the magnetic field and the signal remains low, whilst corresponding to the openings, the field is enclosed and the signal becomes high
The alternating of the signals therefore depends on the succession of the openings (see chapter on "signal management").



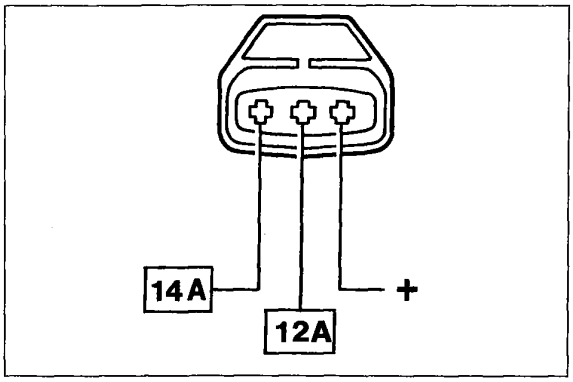
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# 10.



3N28GJ01

Wiring connector




3N28GJ02

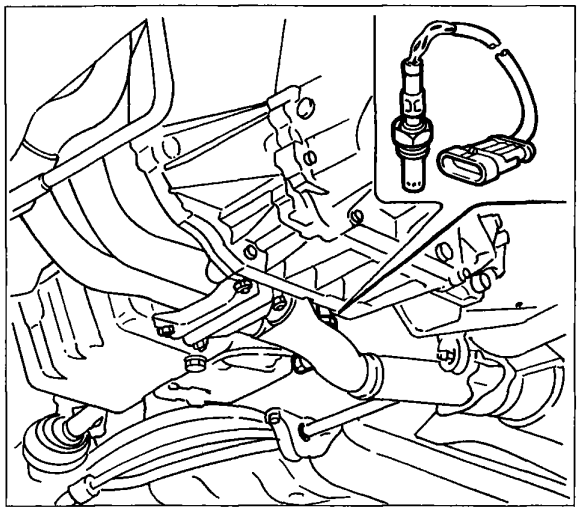
## AIR FLOW METER

The air flow meter is the hot wire type and is incorporated in the butterfly casing.
The upper part contains a duct parallel to the main flow in which the heated filament is located.
Part of the flow of intake air is introduced into the duct and, after having passed through it, it comes out of the opposite side, rejoining the main flow.
As a result, only part of the mass of air which passes through the flow meter is measured: this quantity is, however, proportional to the overall mass passing through the flow meter.
The flow meter electrical output voltage is therefore representative of the total flow rate.
This type of flow meter has two advantages compared with the full flow type:

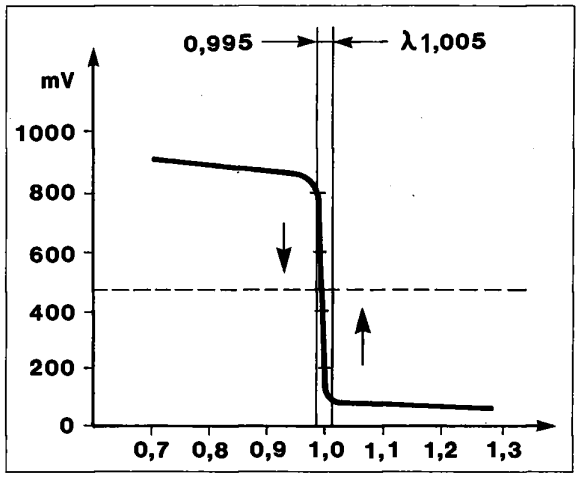
- considerable insensitivity to the pulsing effect of the columns of air, present especially at two speeds and heavy loads;
- less fouling of the filament, thanks to the reduced mass of air coming into contact with it; as a result the control unit has no wire cleaning strategy (burn-in).



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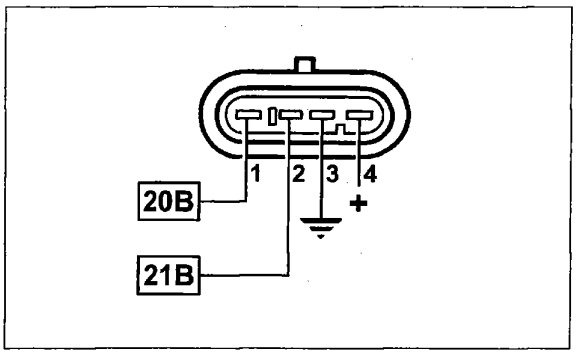
3N29GJ01




3N29GJ02

λ = 1 Ideal mixture (stoichiometric)
λ > 1 Lean mixture
Excess air, the CO values tend to be low
λ < 1 Rich mixture
Lack of air; the CO values tend to be high

Wiring connector




3N29GJ04

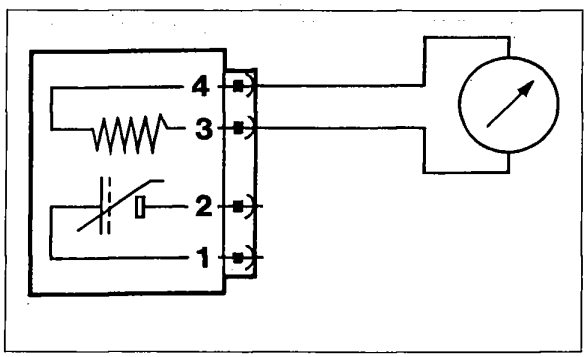
## LAMBDA SENSOR

The Lambda sensor measures the oxygen content in the exhaust gases: it is fitted on the exhaust pipe, upstream of the catalytic silencer.
The sensor output signal is sent to the control unit for feed-back correction of the mixture strength.
When the sensor provides a low signal (voltage below 200 mV) the control unit recognizes a poor mixture and increases the injection time; later on, when the sensor signal is high (voltage above 800 mV), the control unit recognizes a rich mixture and decreases the injection time.
This sequence is repeated at a frequency in the order of tens of Hertz so that the engine runs with a mixture strength continuously fluctuating around the stoichiometric level.
At temperatures below 300°C the ceramic material is not activated, therefore the sensor does not send reliable signals: to make sure that it heats up quickly during starting and the temperature is maintained whilst idling, the sensor is fitted with a heater with an electrical resistance which is always on.

*The sensor can be rapidly put out of action by the presence of even slight amounts of lead in the fuel.*

The sensor heating resistance can be measured by disconnecting the connector and connector an ohmmeter as illustrated in the diagram.

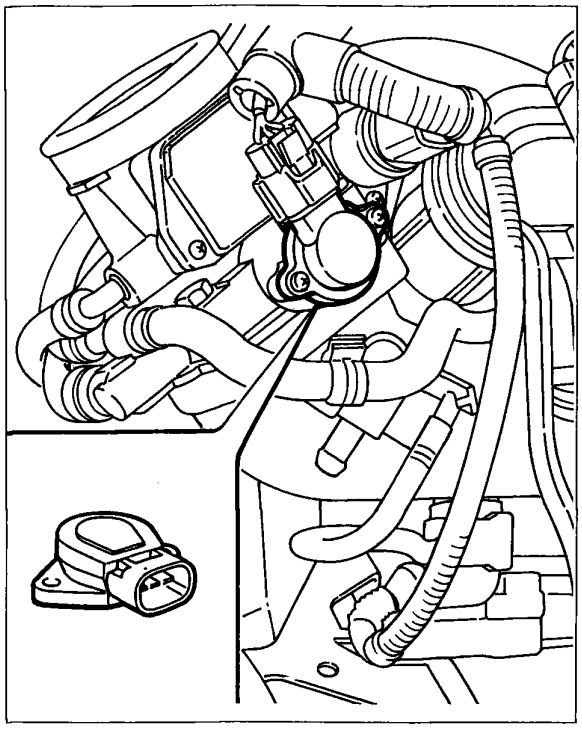
Resistance: **4.5** ± **0.5** ohm at 20°C




3N29GJ03



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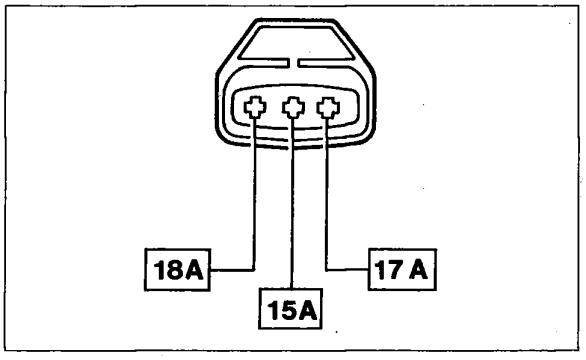


3N30GJ01

## BUTTERFLY POSITION SENSOR

This consists of a single track potentiometer where the moving part is rotated by the accelerator butterfly shaft.

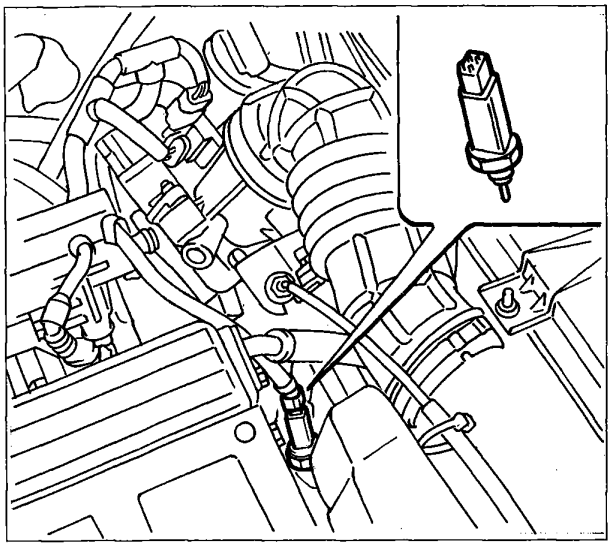
### Wiring connector




3N30GJ02



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3N32GJ01

## ENGINE COOLANT TEMPERATURE SENSOR

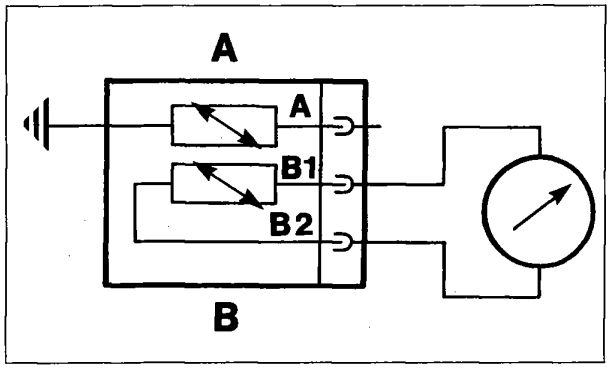
This sensor is fitted on the thermostat.
It consists of a brass casing which affords protection for the resistive elements, comprising two NTC type thermistors (Negative Temperature Coefficient, where the electrical resistance decreases as the temperature increases).
The two thermistors are distinctive and provide information for the instrument panel (A) and the engine management control unit (B), respectively.
The reference voltage for the latter is 5 Volt: since the control unit input circuit is designed as a voltage divider, the reference voltage is shared between a resistance in the control unit and the actual sensor.
As a result, the control unit is capable of evaluating the variations in the sensor resistance through the changes in the voltage, thereby obtaining information concerning the temperature.

**INJECTION NTC**

| °C | Ω | °C | Ω |
|---|---|---|---|
| -20 | 15971 | 40 | 1152 |
| -10 | 9620 | 50 | 807 |
| 0 | 5975 | 60 | 576 |
| 10 | 3816 | 70 | 418 |
| 20 | 2502 | 80 | 309 |
| 25 | 2044 | 90 | 231 |
| 30 | 1679 | 100 | 176 |

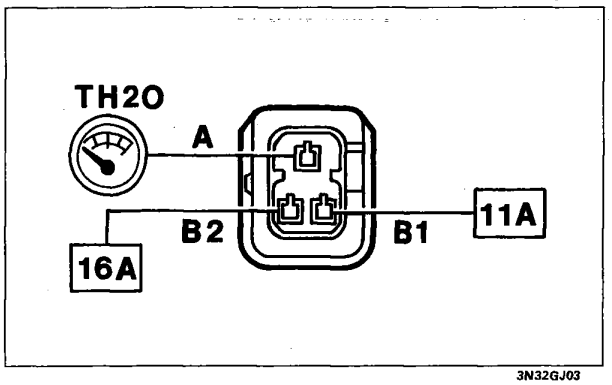
**INSTRUMENT NTC**

| °C | Ω |
|---|---|
| 60 | 512-602 |
| 90 | 184-208 |
| 120 | 76-88 |




3N32GJ02

The table illustrates the sensor progress, which can be measured by disconnecting the connector and connecting an ohmmeter as shown in the diagram.



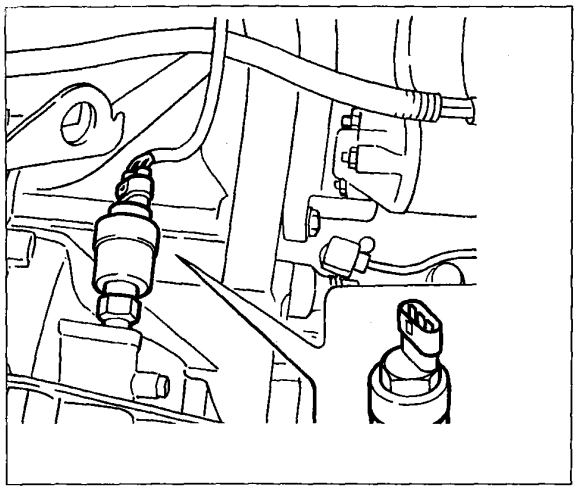

3N32GJ03

Wiring connector



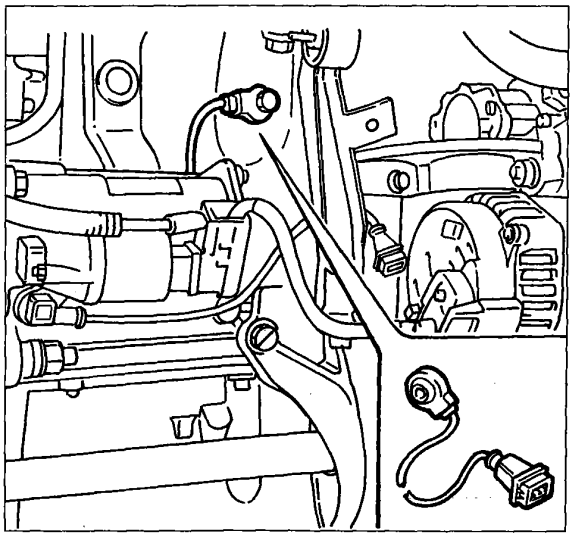
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# 10.



3N33GJ05

Wiring connector

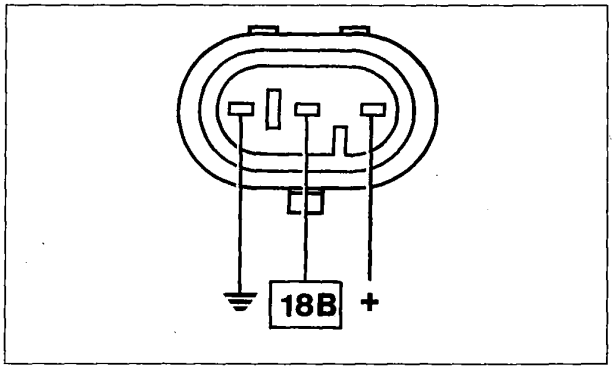


3N33GJ04

Wiring connector

## VEHICLE SPEED SENSOR

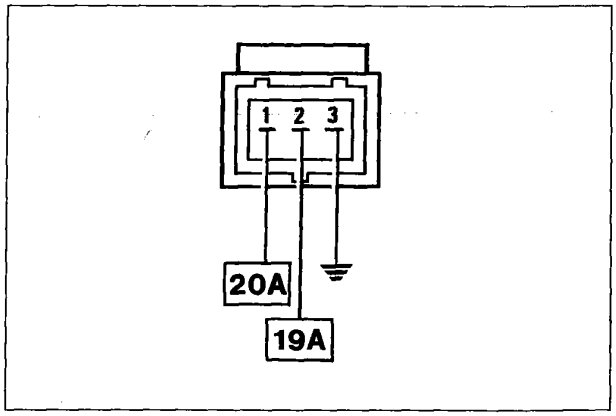
This sensor is positioned at the differential output, by the left driveshaft coupling and it transmits information to the control unit concerning the vehicle speed: the signal is also used for the operation of the speedometer.
The sensor is the Hall effect type (see paragraph on "engine timing sensor") and is calibrated so that each impulse corresponds to a distance of one metre: it is therefore possible to ascertain the speed of the vehicle from the frequency of the impulses.




3N33GJ01

## DETONATION SENSOR

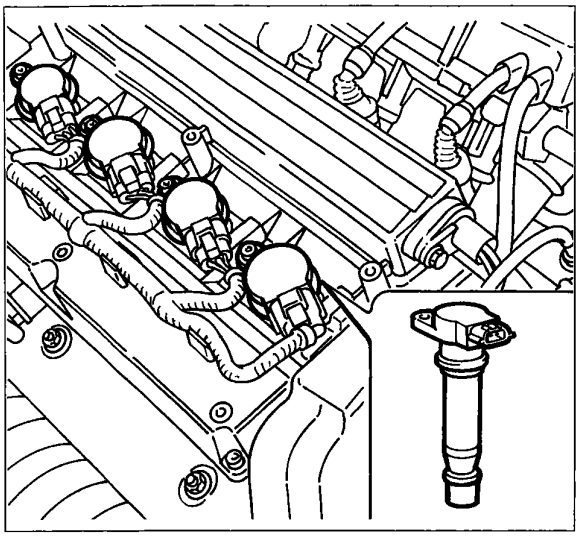
This is a piezoelectric type sensor fitted on the cylinder block/crankcase in a symmetrical position in relation to the pairs of cylinders 1-2 and 3-4.
This position is determined by the need to detect the onset of detonation in the same way for all cylinders.
When the engine is knocking, crankcase vibrations of a particular frequency are produced which are transformed by the sensor into a voltage signal proportional to their intensity.




3N33GJ02



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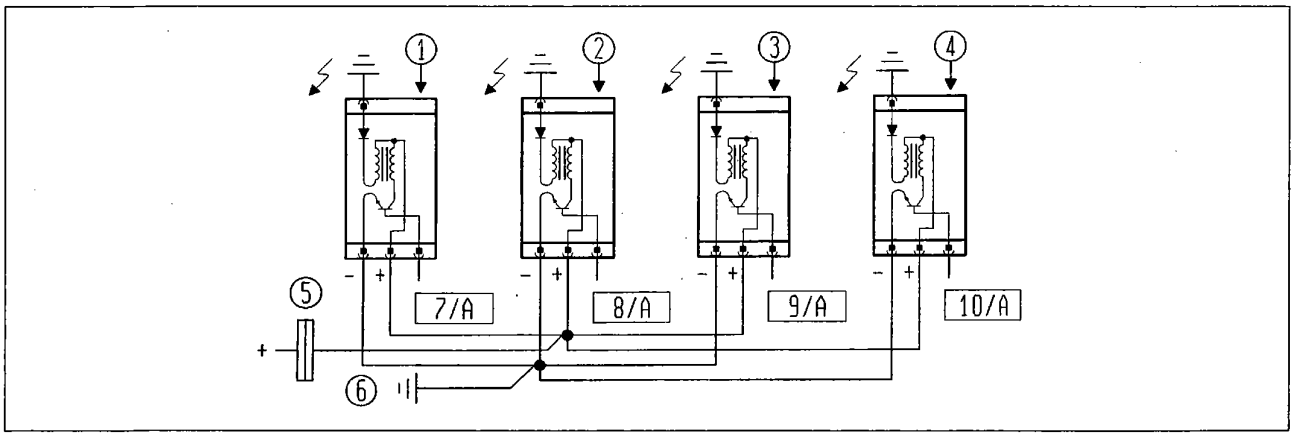


3N34GJ01

## IGNITION COIL

The ignition circuit is the inductive discharge, static advance type where the high voltage is supplied by four coils fitted directly on the spark plugs (pencil-coils).
The coil used is the closed magnetic circuit type, with the windings in a plastic container immersed in epoxide resin. The coil is connected directly to the spark plug by means of a silicon extension which has good dielectric properties.
The coil incorporates a power transistor for interrupting the primary winding.
The primary winding of each coil is supplied by the battery voltage (+30) by means of the twin relay and is connected to earth via the built in power transistor whose base is connected to the control unit pin.

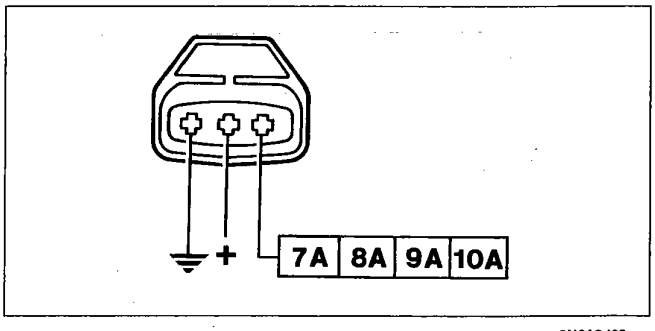
Interrupting the current to the base of the transistor interrupts the connection to earth of the primary winding and, as a result, causes the high tension discharge at the secondary winding.
The optimum ignition advance is calculated by the control unit according to the engine speed and load conditions and is implemented in the form of time between the TDC for the explosion stroke and the moment the supply in the coil primary winding is interrupted.




3N34GJ02

1. Cylinder 1 ignition coil
2. Cylinder 2 ignition coil
3. Cylinder 3 ignition coil
4. Cylinder 4 ignition coil
5. Interface connector
6. Engine earth

Wiring connector

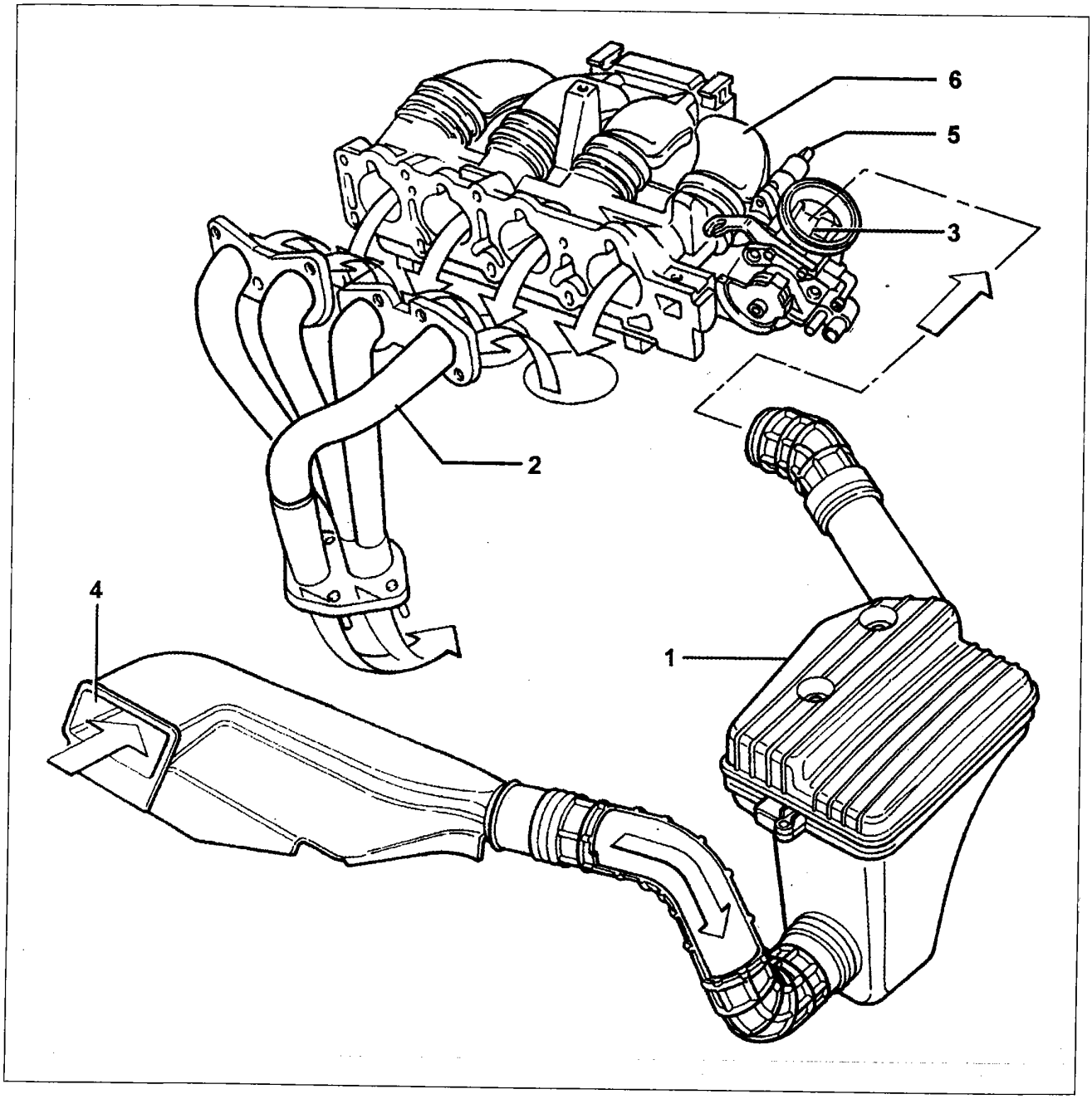



3N34GJ03



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## DIAGRAM SHOWING AIR INTAKE CIRCUIT




4F032OJ01

1. Air filter
2. Exhaust manifold
3. Butterfly casing with air flow meter
4. Intake vent
5. Engine speed adjustment actuator
6. Intake manifold



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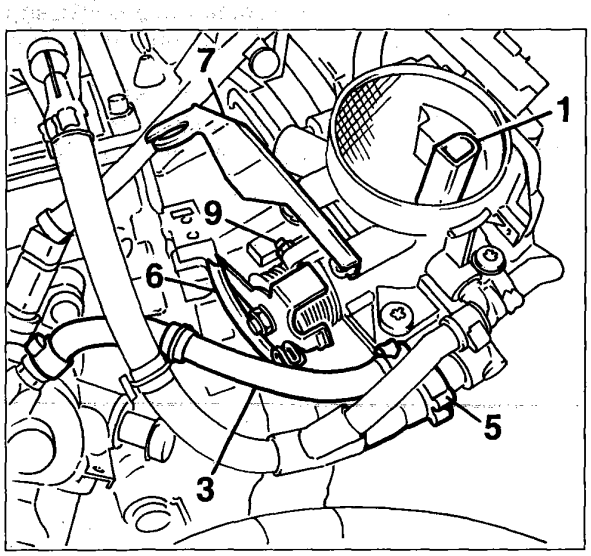
## INTAKE CIRCUIT

The intake circuit consists of the following components:
- air filter and hoses;
- acoustic resonators fitted in parallel to the intake hose (two upstream and two downstream of the filter);
- intake manifold on which the fuel manifold, complete with injectors, the engine management control unit and the charcoal filter solenoid valve are fitted
- butterfly casing, incorporated with the air flow meter, on which the butterfly position sensor, the oil vapour recirculation circuit PCV valve and the engine idle speed adjustment actuator are fitted.

## BUTTERFLY CASING

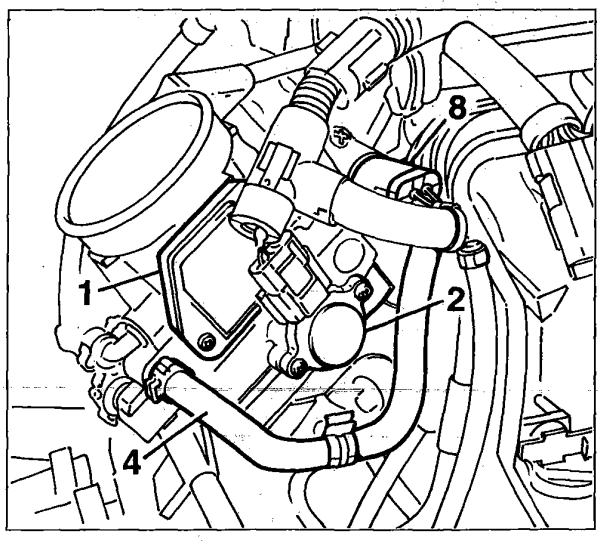
The butterfly casing has the task of metering the quantity of air drawn in by the engine (and consequently the power developed) according to the request from the driver via the accelerator and it is incorporated with the air flow meter.
The butterfly casing is fixed to the intake manifold by four bolts: the butterfly is opened by means of linkage with small butterfly opening angles corresponding to the pedal slightly pressed and large angles corresponding to when it is very depressed.
With the pedal completely released (engine decelerating or idling), the additional air required is supplied by the engine idle adjustment actuator: under these circumstances, the butterfly opening lever is in the end of travel position against an anti-tamper screw which prevents the butterfly from getting stuck in the closed position.
To prevent ice forming near the butterfly and the port connected to the PCV valve, the butterfly casing is heated by a small amount of coolant, coming from the engine thermostat, circulating in a chamber inside the actual casing.
The oil vapour recirculation system PCV valve and the butterfly position sensor are also fitted on the butterfly casing.

*The anti-tamper screw is adjusted during the fluxing operation in the factory and should never be tampered with.*




3N36GJ01

1. Air flow meter
2. Butterfly position sensor
3. Engine coolant inlet
4. Engine coolant outlet
5. PCV valve



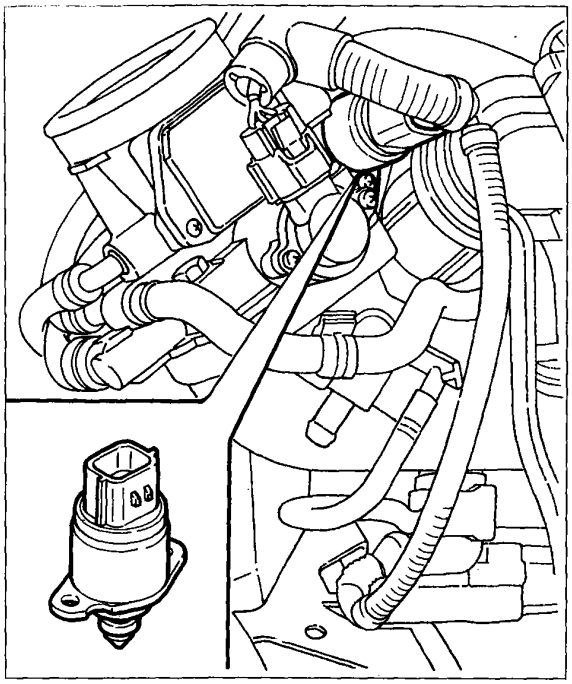

3N36GJ02

6. Accelerator control lever
7. Accelerator cable adjustment bracket
8. Idle speed adjustment actuator
9. Anti-tamper screw



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# 10.



3N37GJ01

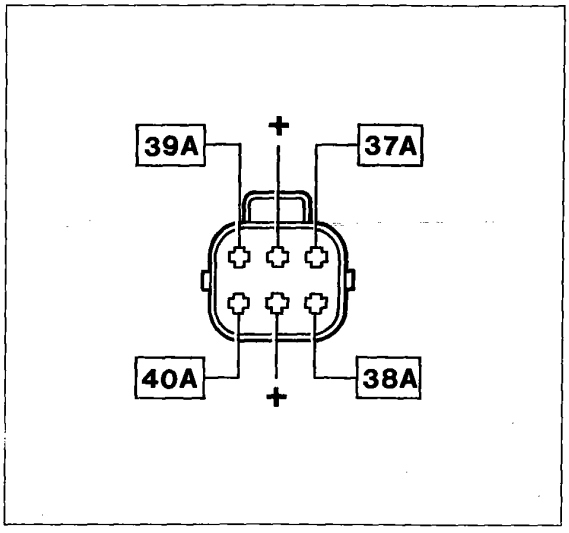
## ENGINE IDLE SPEED ADJUSTMENT ACTUATOR

The actuator, fitted on the butterfly casing, intercepts a flow of air which, taken from upstream of the butterfly, returns it downstream: it has the task of guaranteeing the additional air for the engine with the butterfly closed in all conditions where it is required (idling, deceleration).
**A** stepping motor is used to achieve the latter and it is fixed to the butterfly casing and operated by a circuit inside the engine management control unit.

### Operating principle

The actuator consists of:
- an electric stepping motor which has two windings in the stator and a rotor which includes a certain number of pairs of permanent magnet poles;
- a screw-female screw type reduction gear which transforms the rotary motion into rectilinear motion.

The stepping motor is operated by the engine management control unit which, combining the offset and the direction in which the current flows through the windings, causes the rotor to rotate in both directions through a given number of steps.
The screw-female screw coupling causes the movement of stem, fitted with a tapered shutter, which varies the passage of the by-pass duct and, as a result, the quantity of air drawn in by the engine to obtain the desired speed even when external loads are applied (air conditioning, fans, power assisted steering, etc.).



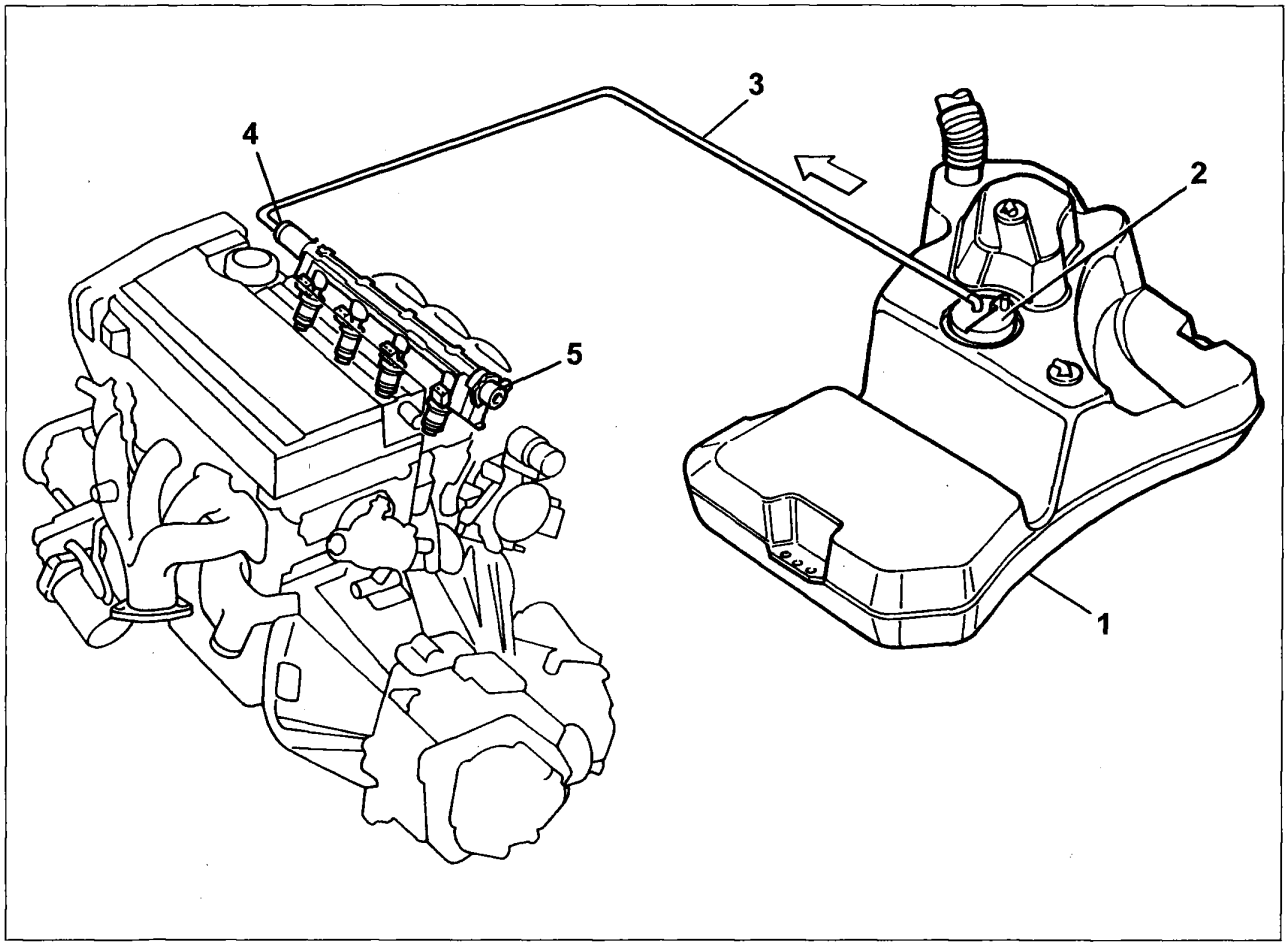

3N37GJ02

Wiring connector



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## DIAGRAM SHOWING FUEL CIRCUIT




4F035OJ01

1. Fuel tank
2. Drip tray complete with pump, filter, pressure regulator and gauge float
3. Supply pipe
4. Returnless type fuel manifold
5. Air bleed connector

## FUEL SUPPLY CIRCUIT

This circuit consists of the following components:

- Fuel tank
- Drip tray complete with pump, filter, pressure regulator and gauge float
- Supply pipe
- Returnless type fuel manifold complete with injectors



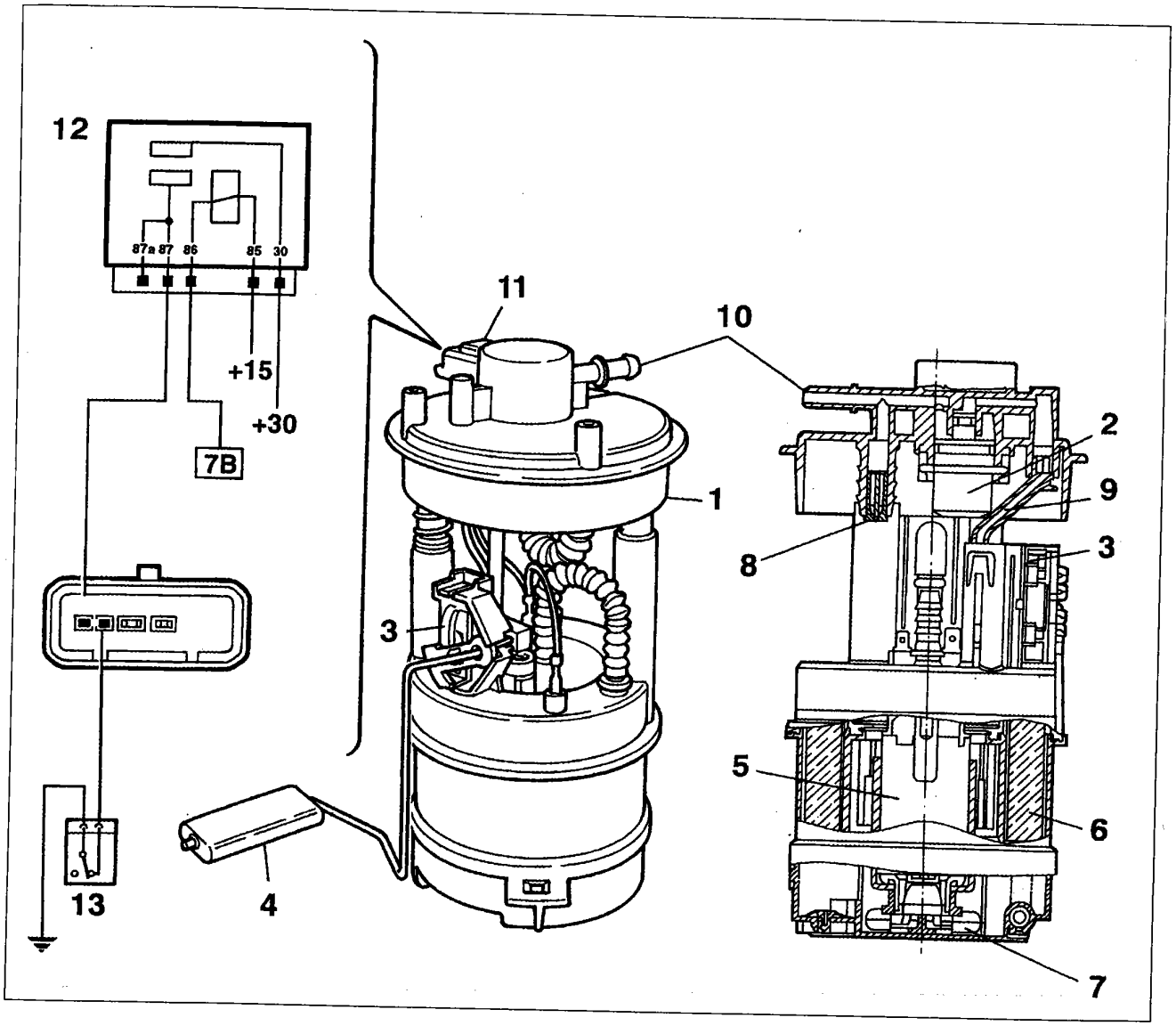
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# 10.

## FUEL DRIP TRAY

### Electric fuel pump

The pump is housed inside the fuel tank on a special drip tray which also supports the gauge and is fitted with a gauze filter on the pump intake. The pressure regulator is also fitted on the pump supply.



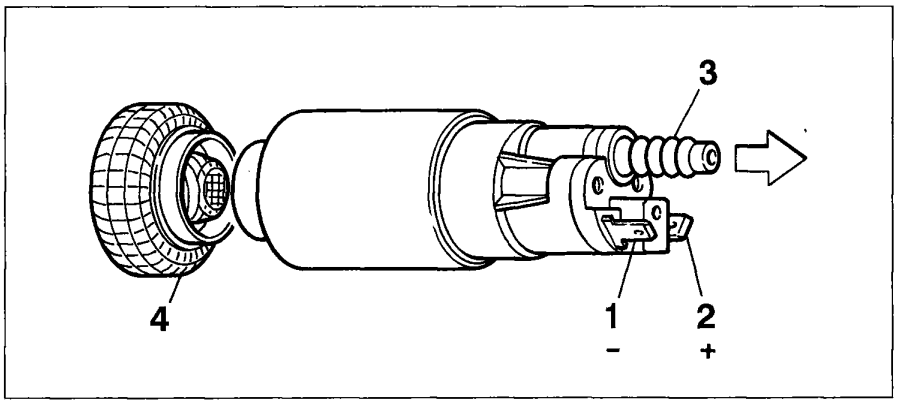

1. Complete drip tray
2. Pressure regulator
3. Gauge
4. Float
5. Electric pump
6. Fuel filter
7. Pre-filter
8. Single-acting valve
9. Internal fuel return
10. Fuel supply
11. Electrical connector
12. Relay
13. Inertia switch



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The pump is the volumetric type and is designed to run on unleaded fuel. The rotor is driven by a d.c. electric motor supplied with the battery voltage directly by the twin relay operated by the control unit in order to ensure:

- that the pump cuts out if the engine speed goes below a minimum level (around 450 rpm);
- the timed operation (around 15 seconds) each time the ignition is turned to the ON position and the engine is not started up;
- operation when the engine has been started.



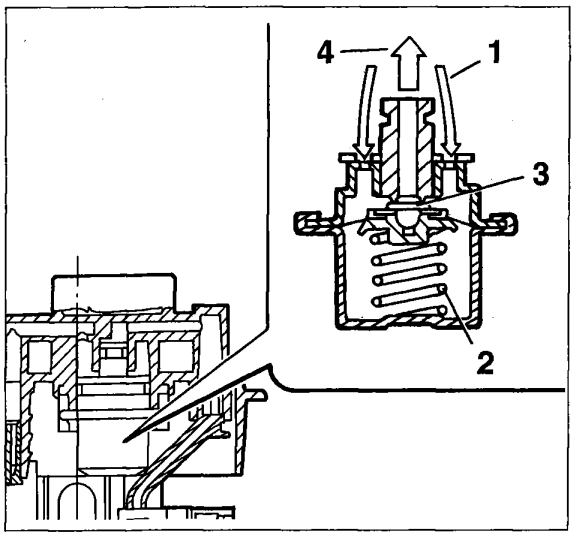

3N41GJ01

1. Negative
2. Fuel system
3. Supply
4. Pre-filter

The pump is equipped with an excess pressure valve which short circuits the supply with the inlet if the pressure in the supply circuit exceeds 5 bar to prevent the electric motor from overheating.
In addition, a one-way valve fitted on the supply prevents the entire fuel circuit from being drained when the pump is not working.
The nominal flow rate of the pump varies according to the speed of the rotor and consequently the supply voltage.

### Fuel filter

The fuel filter is contained in the pump housing and does not require periodic replacement




3N41GJ02

### Fuel pressure regulator

This is a differential diaphragm device, regulated during manufacture to a pressure of 3.50±0.05 bar and located in the top part of the drip tray.
The pressurized fuel (1), coming from the pump, exerts a force on the flow valve (3) opposted by the calibrated spring (2). When the calibration pressure is exceeded, the valve opens and the excess fuel (4) returns to the tank, thereby stabilizing the pressure in the circuit.

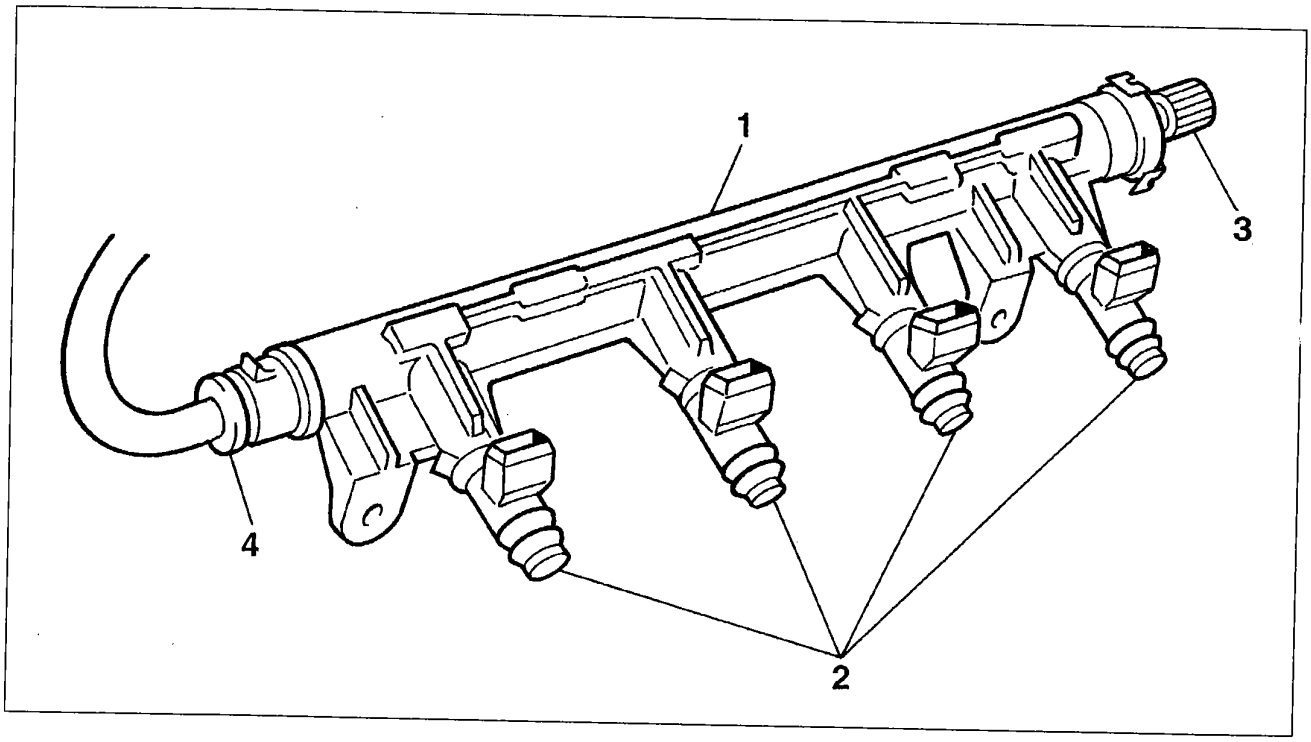


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# 10.

## FUEL MANIFOLD

The fuel manifold, which has the task of distributing the fuel to the injectors, is produced by aluminium die-casting and incorporates the seats for the injectors and the bleed valve.
The fuel intake is fixed by a tapered bolt. Since the system is the returnless type, there is no recirculation pipe.




3N42GJ02

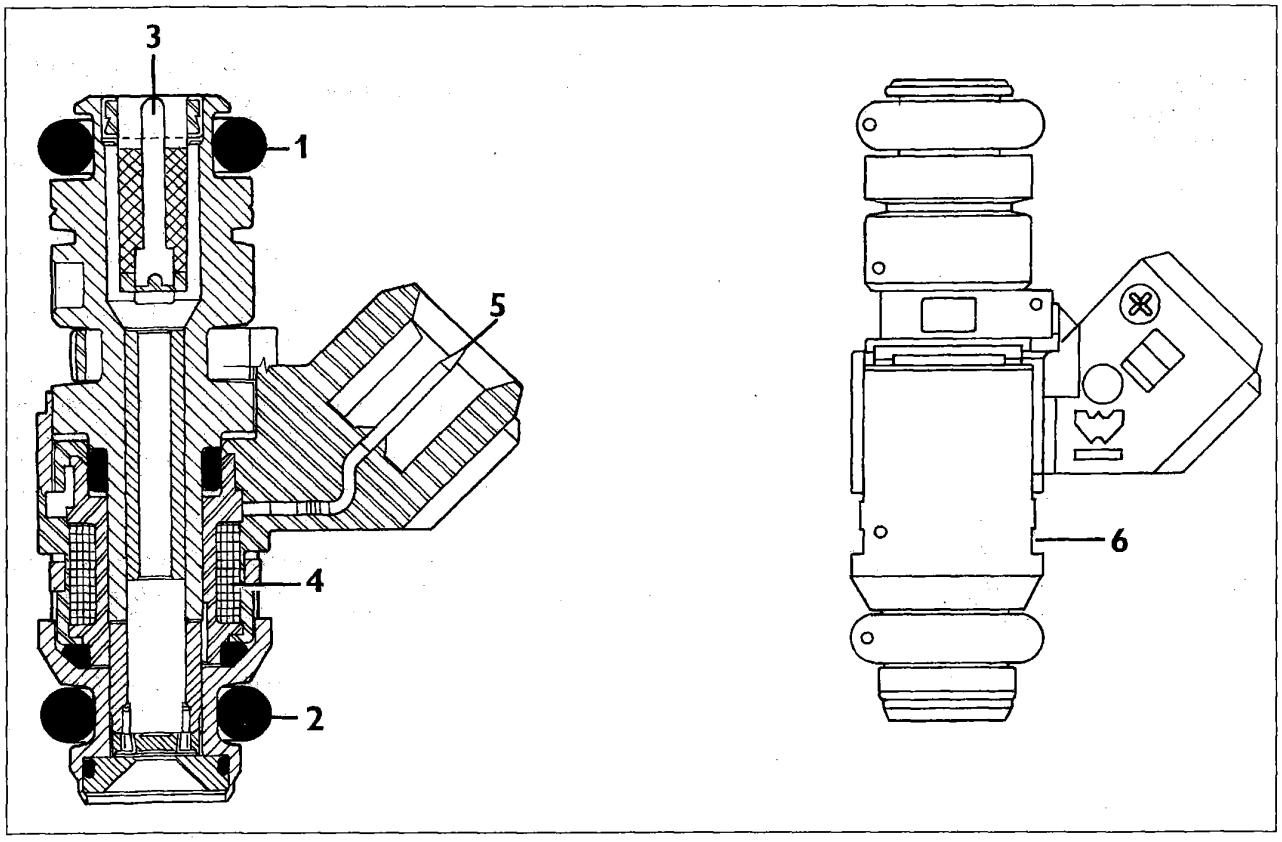
1. Fuel manifold
2. Injectors
3. Bleed valve
4. Fuel supply connector



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## INJECTORS

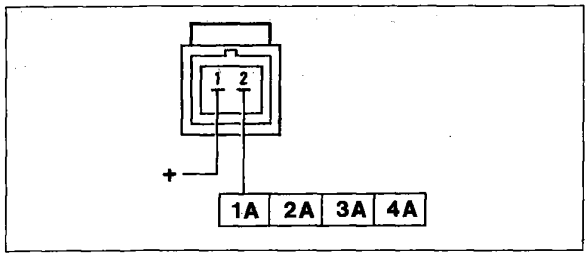
The injector has the task of supplying the quantity of fuel needed for the engine to run: the fuel is injected into the intake manifold, immediately upstream of the inlet valves.
The injectors are the top-feed, twin jet type with the supply (3) of fuel at the top of the casing where the electrical winding (4), connected to the connector terminals (**5**) is also housed.
When the current passes through the winding, the magnetic field which is created attracts the shutter, causing the opening of the injector and the flow of fuel.
Two seals provide the seal on the fuel manifold side (**1**) and the intake manifold side (2). A reference (6) determines the angular position of the injector in relation to the intake manifold to ensure that the jets are correctly positioned in relation to the inlet valves.




3N43GJ01

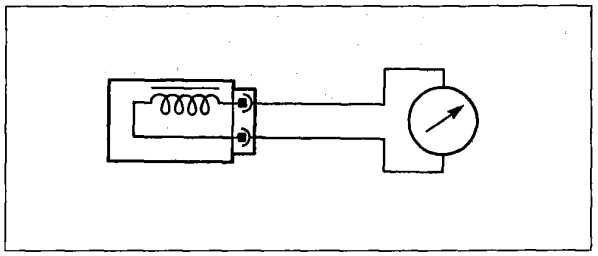
The injector resistance can be measured by disconnecting the connector and connecting an ohmmeter as illustrated in the diagram.

**Wiring connector**




3N43GJ02

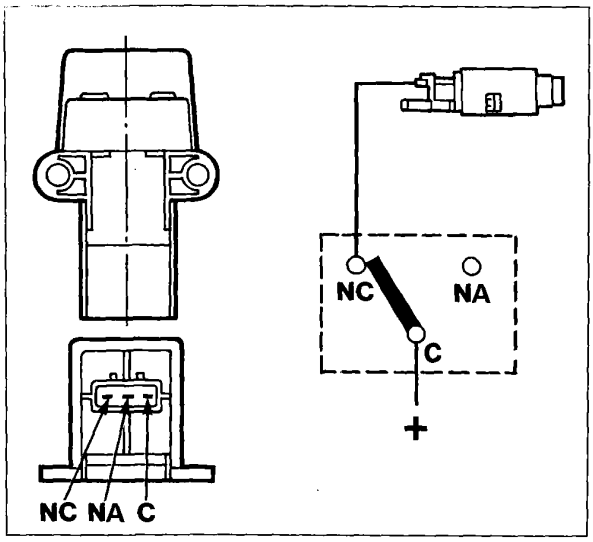
**Resistance value: 14.5 ± 5% ohm.**



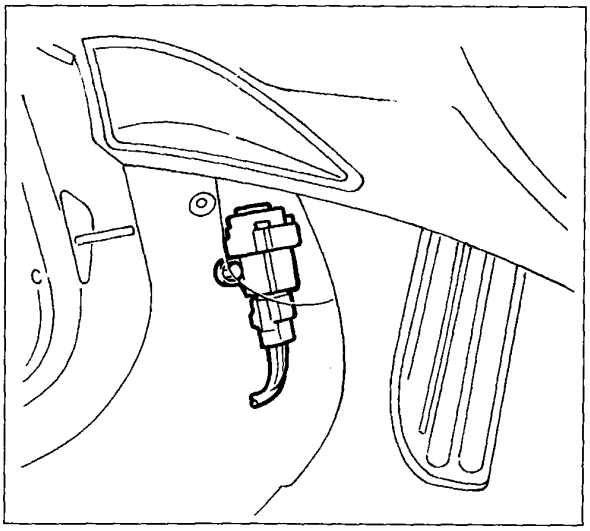
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3N44GJ01




4A34JJ02

1. Inertia sensor
2. Button for restoring operation of electric fuel pump

## INERTIA SAFETY SWITCH

In order to improve the safety of the occupants of the vehicle in the case of an impact, the vehicle is equipped with an inertia switch, located under the dashboard on the driver's side, fastened to the left side panel, near the bonnet release.

The inertia switch has the task of interrupting the electrical supply for the fuel pump if the vehicle undergoes violent deceleration (impact) to prevent fuel from being able to escape, if the fuel manifold or the supply pipes are damaged, and create a fire hazard.

The switch consists of a steel ball, fitted in a conical shaped housing and kept in positino by the attraction force of a permanent magnet.

As a result of the acceleration due to the inertia forces, the ball can be released from the magnetic clip and gradually come out of the tapered housing with an upwards movements which depends on the angle of the cone.

There is a rapid release mechanism, above the ball, which forms a normally closed (NC) circuit. When the mechanism is struck by the ball, it changes position into a normally open (NA) circuit, thereby interrupting the electric supply to the pump and causing it to cut out.

The calibration of the switch causes it to intervene at accelerations of above 1.2 g (about 11.7 $m/s^2$, corresponding to an impact at a speed of about 25 Km/h).

The switch can be turned back on by pressing the top button with the protective cover.

*Even after an apparently slight impact, if there is a smell of fuel or there are leaks from the fuel system, the switch should not be turned back on, but the cause of the problem sought and remedied to prevent the risk of fire.*
*If this is not the case and there are no leaks, the vehicle can be driven again and the button should be pressed to reactivate the pump.*



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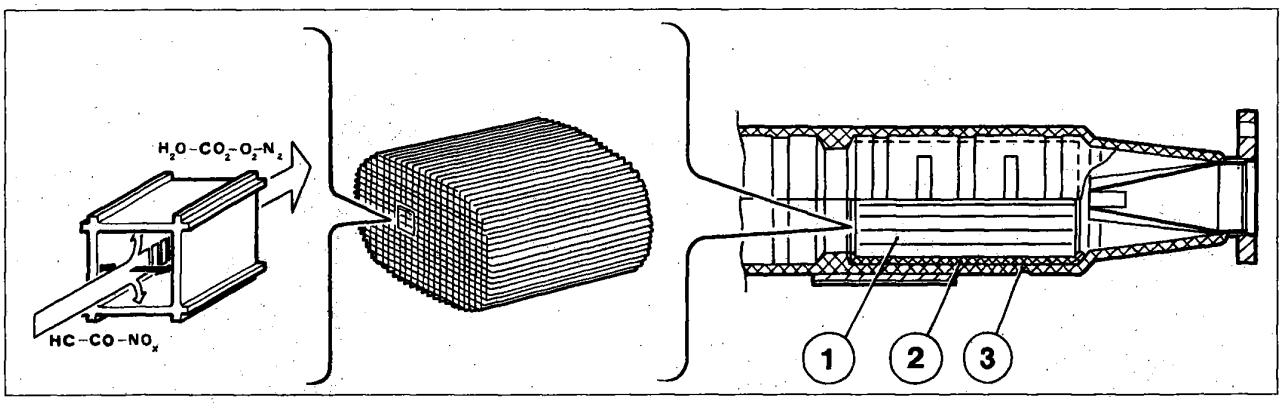
## EMISSION CONTROL DEVICES

These devices have two aims:
- to keep down the levels of pollutant substances present in the exhaust, by means of the catalytic silencer;
- to eliminate the dispersion into the atmosphere of the unburnt hydrocarbons, through the (fuel) anti-evaporation system and the (lubricant) oil vapour recirculation system.

## CATALYTIC SILENCER

The catalytic silencer is a device which makes it possible to keep down the levels of the three main pollutant compounds present in the exhaust simultaneously: unburnt hydrocarbons (HC), carbon monoxide (CO) and nitrogen oxides (NOx).
Two types of chemical reactions take place inside the catalyzer:
- oxidation of the CO and HC, converted into carbon dioxide ($CO_2$) and water ($H_2O$);
- reduction of the NOx, converted into nitrogen ($N_2$).

These reactions can take place extremely quickly thanks to the presence, inside the structure (ceramic support) of the catalyzer, of a layer of active substances (platinum and rhodium) which greatly accelerate the conversion speed of the harmful substances.
The effectiveness of this conversion process is conditioned by the fact that the mixture strength on which the engine is running is continuously fluctuating around the stoichiometric value, which is achieved thanks to the feed-back control carried out by the control unit on the basis of the Lambda sensor signals.
Lastly, the conversion processes are activated at temperatures in excess of 300 - 350°C: it is therefore vital for the catalyzer to reach this temperature as quickly as possible in order to be able to work properly.




3N45GJ01

1. Ceramic structure
2. Metal support
3. Outer steel casing

*when work hs to be carried out in the vicinity of the catalytic silencer, the vehicle must be left for a certain length of time because the operating temperature inside the catalyzer is between 500 and 850°C.*

*There are basically two causes which can destroy the inside of the catalyzer:*
- *the presence of lead in the fuel which lowers the degree of conversion to practially zero (lead poisoning) and irreparably damages the Lambda sensor as well;*
- *the presence of completely unburnt fuel in the exhaust gases, due to failed ignition, which causes an increase in temperature which leads to the ceramic support melting. As a result, the connector for the coils must never, under any circumstances, be disconnected with the engine running: in the case of tests, the silencer must be replaced with an equivalent length of pipe.*



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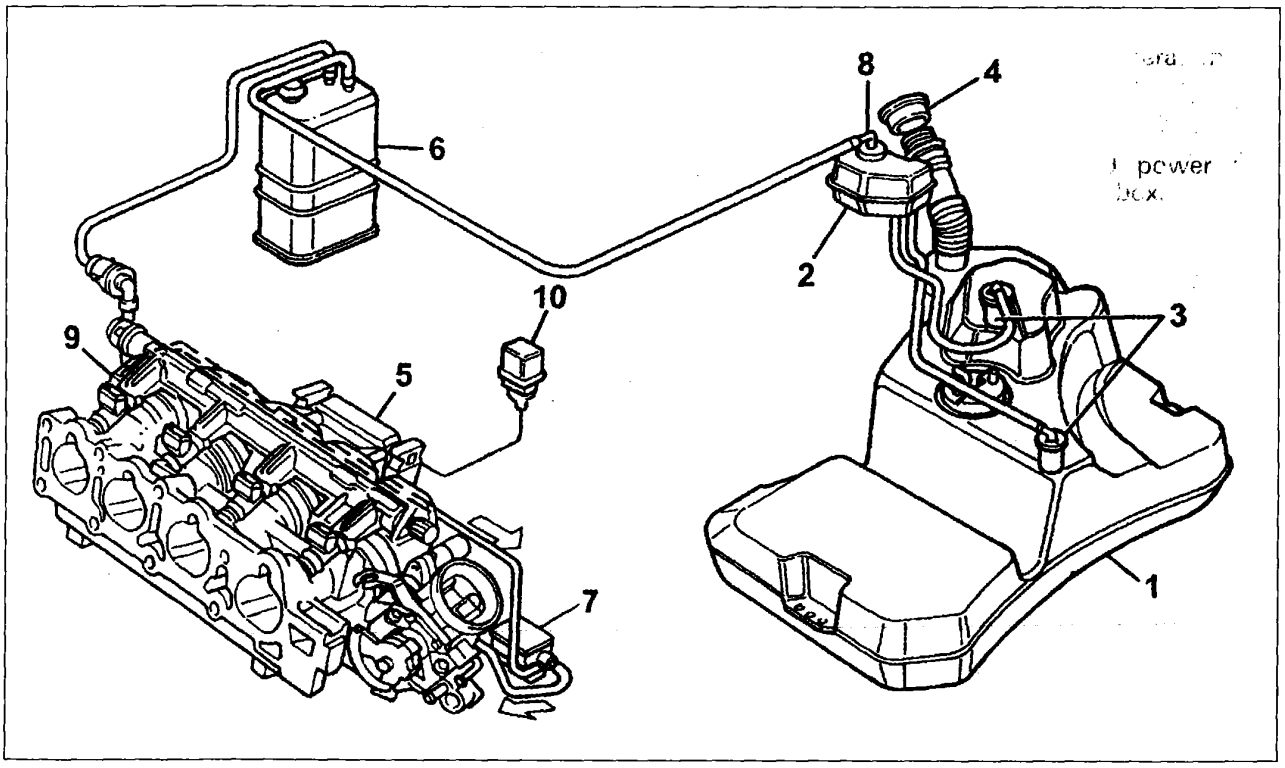
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## FUEL ANTI-EVAPORATION SYSTEM

The anti-evaporation system is designed to prevent the fuel vapours, composed of the lightest fractions of hydrocarbons which basically form in the tank, from being discharged into the atmosphere.
The system consists of the tank, the vapour separator, two float valves, a two-way ventilation valve, the charcoal filter and a charcoal filter solenoid valve controlled by the control unit. The cap contains a two-way safety valve.

### Operating principle

The system operates, above all, at high outside temperatures when the temperature of the fuel increases and, consequently, the tendency to evaporation increases: in this situation there is an increase in pressure inside the tank.
In particular, even when the tank (1) is full, the two float valves (3) remain open, as they are located higher than the breather pipe and therefore always allow the fuel vapours to reach the separator (2), thereby preventing fuel from escaping.
The fuel vapours reach the charcoal filter (6) when the pressure inside the tank causes the opening of the ventilation valve (8). This valves also allows an intake of air into the tank through the charcoal filter, if necessary, when the level of the fuel decreases.
When the engine is running, the control unit operates the charcoal filter solenoid valve which allows the intake of vapours by the engine and the consequent scavening of the charcoal filter.
If, as a result of a malfunction with any of the components, the pressure inside the tank increases to dangerous levels, the safety valve, located in the cap (4), allows the pressure to be discharged outwards. If necessary, this valve can open in the opposite direction to ventilate the tank and prevent the vacuum levels from becoming excessive.




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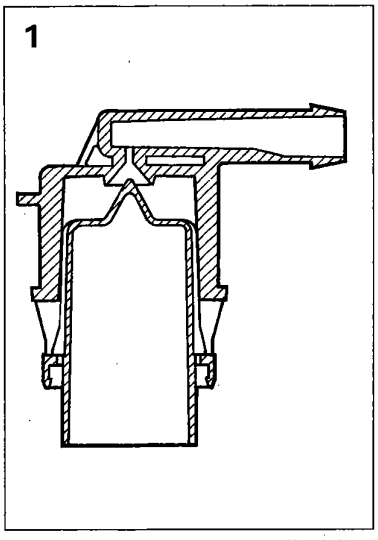
1. Fuel tank
2. Vapour separator
3. Float valve
4. Cap with safety valve
5. Engine management control unit
6. Charcoal filter
7. Charcoal filter solenoid valve
8. Safety and ventilation valve
9. Inlet manifold
10. System relay



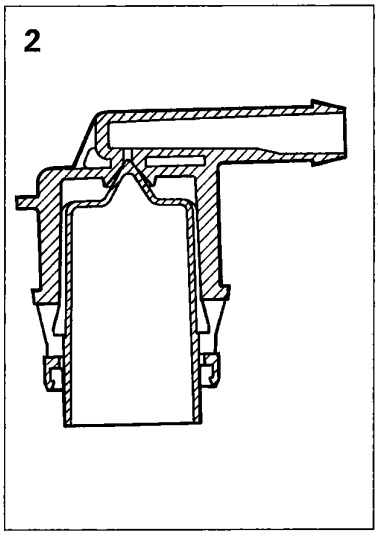
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## Float valve

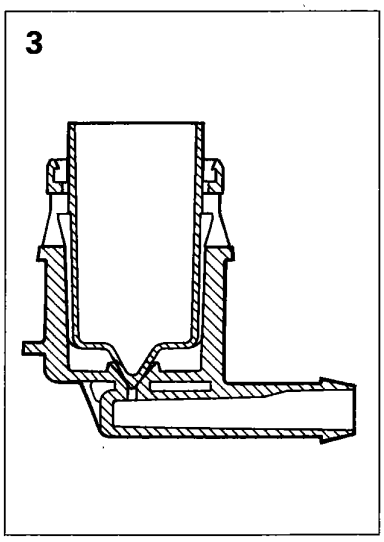
The float valve has the task of allowing the flow of vapours to the separator, without, however, allowing the escape of liquid fuel.
The valve contains a float, the end of which closes the actual valve outlet port in the following conditions:
strong lateral acceleration (vehicle driving round a bend) or longitudinal acceleration (vehicle braking) with the relevant movement of the mass of fuel as a result of the inertia force;
vehicle overturning.



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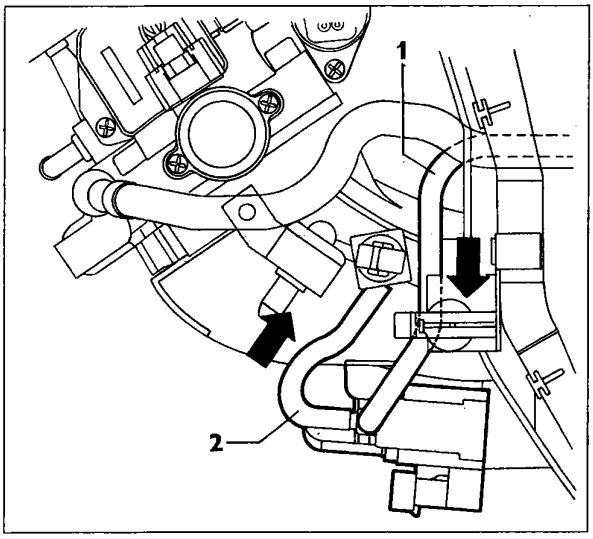


3N48GJ02



3N48GJ03

1. Normal operating conditions: valve open
2. The fuel pushes the float upwards as a result of strong acceleration: valve closed;
3. Vehicle overturned: valve closed.



3N49GJ03

## Charcoal folter solenoid valve

This normally closed type valve, controls the flow of vapours reaching the intake manifold, being operated by the control unit in a duty-cycle.

1. From the charcoal filter
2. To the intake manifold

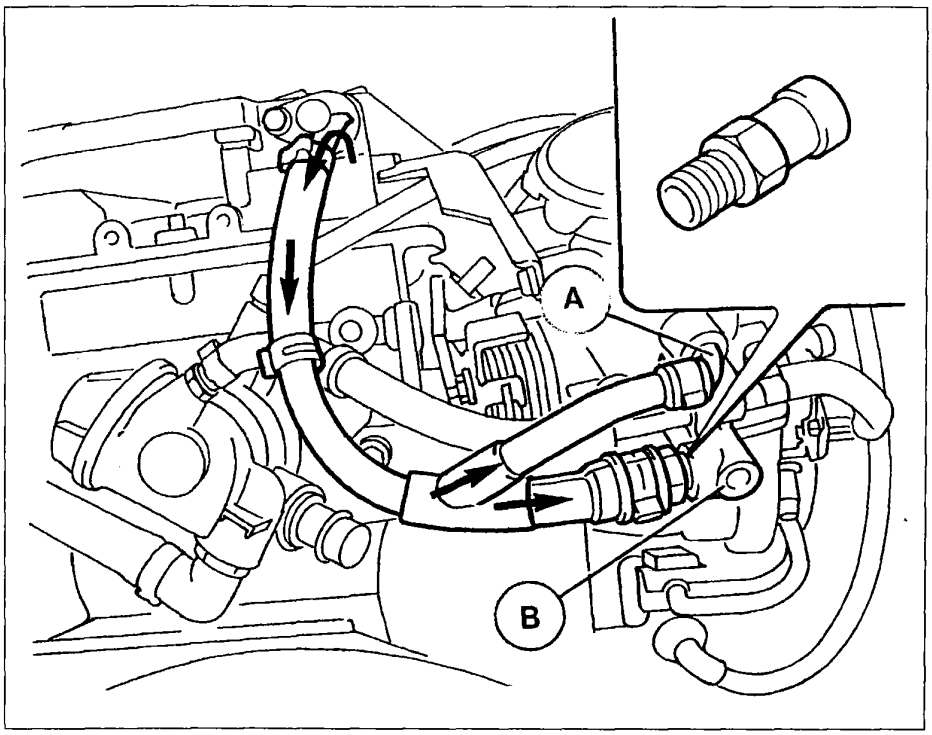


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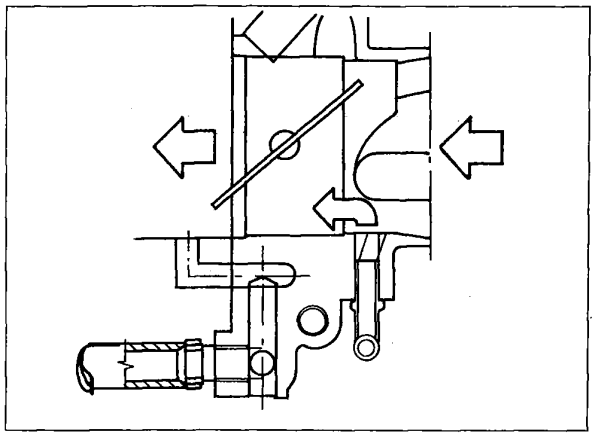
## EXHAUST GAS RECIRCULATION SYSTEM (BLOW-BY)

This system controls the emission of breather gases from the crankcase which consist of mixtures of air, fuel vapours and burnt gases which escape from the piston seals and lubricant oil vapours, causing them to be recirculated and burnt in the engine.
The breather gases coming from the crankcase rise as far as the cylinder head and are directed into two different intakes:
- at medium-high accelerator butterfly openings, the gases are drawn in by the duct immediately downstream of the air flow meter (detail A);
- at small butterfly openings (and, in particular, with the engine idling or decelerating), the gases are drawn ni through the PCV valve (Positive Crank Ventilation) fitted on the butterfly casing downstream of the actual butterfly (detail B).

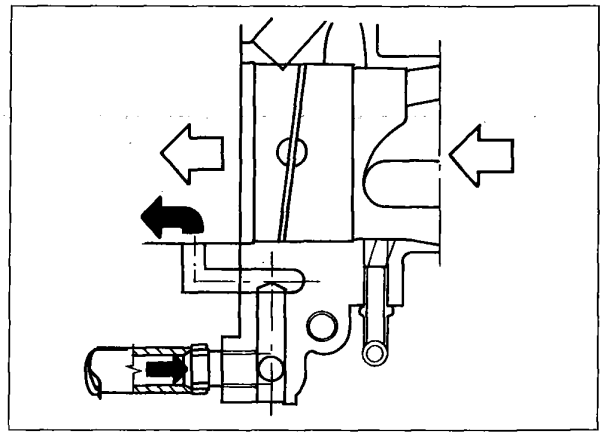


3N50GJ01

### Detail A


3N50GJ02

### Detail B


3N50GJ03



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## CHECKS, ADJUSTMENTS AND REPAIR OPERATIONS ON THE HITACHI MPI SYSTEM

*The following precautions must be observed when working on a vehicle equipped with a Hitachi MPI system:*
*do not start the engine when the electrical leads are not properly connected or are slack at the battery terminals;*
- *do not use a rapid battery charger to start the engine;*
- *never disconnect the battery from the electrical system with the engine running;*
- *when recharging the battery, it must be disconnecte first from the electrical system;*
- *if the vehicle is going into a drying oven after painting at temperatures above 80°C, then the engine management control unit must be removed from the vehicle first;*
- *do not connect/disconnect the control unit multiple connector with the ignition switched ON;*
- *always disconnect the negative battery lead before carrying out electrical welding on the vehicle.*

*The system has a memory which is supplied directly by the battery, even when the ignition is switched off, where the values acquired during the self-adjustment are stored. The operation of disconnecting the battery means that this data is lost and can only be acquired again after a certain length of time: this operation should therefore be carried out as infrequently as possible.*

**NOTE** *If the Hitachi MPI sysetm components are replaced:*
- *Butterfly casing and flow meter*
- *Engine idle speed actuator*
- *Butterfly position sensor*
- *Engine management control unit*
- *Lambda probe*

*The negative battery terminal must be disconnected in order to reset the self-adjustment memory which could, with new components, involve the failure of the engine to start or the irregular behaviour of the engine when first started.*

### CHECKING CONCENTRATION OF EMISSIONS

The system manages the advance, the carbon monoxide (CO) content and the idle air flow rate without any possibility of manual adjustment.
However, a check on the content of the exhaust gases, upstream and downstream of the catalyzer, can provide useful information on the injection/ignition system operating conditions, the engine parameters and the catalyzer.

#### Checking idle concentration of CO and HC upstream of the catalytic silencer

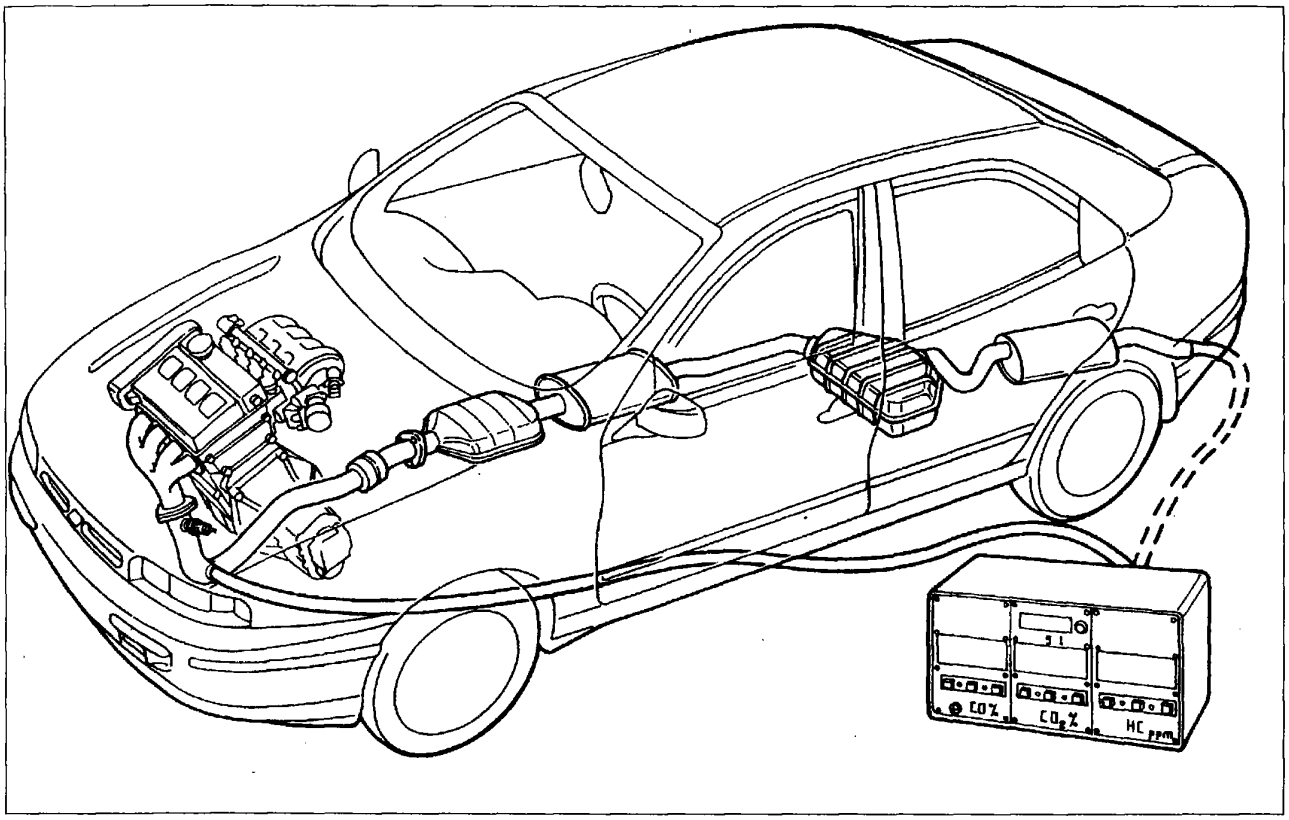
To check the concentration of carbon monoxide (CO) and unburnt hydrocabons (HC) upstream of the catalyzer, proceed as follows:

1. Undo the cap located on the exhaust pipe, upstream of the catalyzer, and tighten the tool in its place.
2. Connect a suitably calibrated CO-tester probe to the tool.
3. Start up the engine and let it reach operating temperature.
4. Check that the idle speed is correct.
5. Check that the idle CO concentration is within the recommended limits (see table); if this is not the case, it is necessary to check:
   - that the Lambda sensor is working properly, using the diagnostic equipment;
   - for the presence of air penetration in the area surrounding the Lambda sensor housing;
   - the injection and ignition system (in particular the state of wear of the spark plugs).
6. In the same conditions, check that the concentration of HC is below 500 p.p.m.
7. If the values do not correspond, tune the engine, checking, in particular:
   - the valve gear timing;
   - the engine compression.

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Table summarizing pollutant emission tolerance figures

| | CO (%) | HC (p.p.m.) | $CO_2$ (%) |
|---|---|---|---|
| Upstream of the catalyzer | 04 - 1 | < 500 | > 12 |
| Downstream of the catalyzer | < 0.35 | < 90 | > 13 |

## Checking exhaust concentration of CO and HC

The concentration of carbon monoxide (CO) and unburnt hydrocarbons (HC) at the exhaust is measured by inserting a suitably calibrated tester sensor at least 30 cm into the end of the exhaust pipe.

1. Check that the idle CO and HC concentrations correspond to the recommended figures (see table).
2. If the HC value is outside of the recommended limit, whilst that measured previously upstream of the catalyzer was correct, then the engine parameters are correct the cause of the problem should be sought in the decreased efficiency of the catalyzer.

## CHECKING ENGINE IDLE SPEED

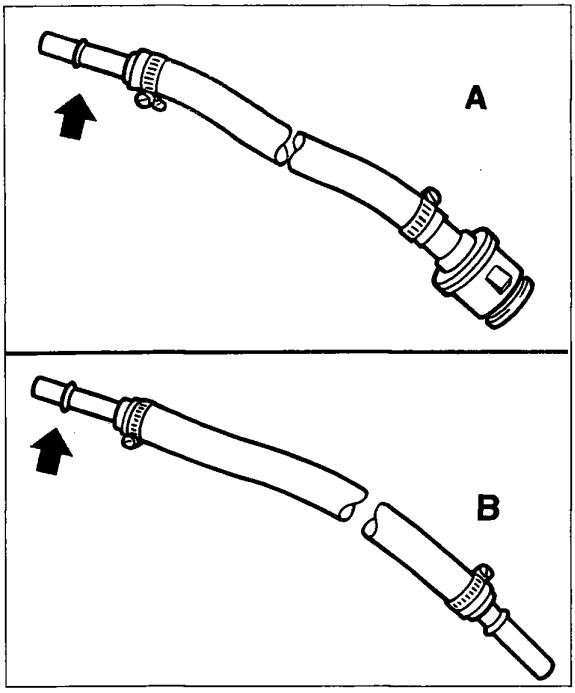
If the engine idle speed does not correspond to the recommended figure and the system is the self-regulating type, then no adjustment can be carried out: it is therefore necessary to check that the accelerator linkage is correctly adjusted and the cause of the problem should be sought by carrying out a complete fault diagnosis using the diagnostic equipment.

## CHECKING IGNITION ADVANCE

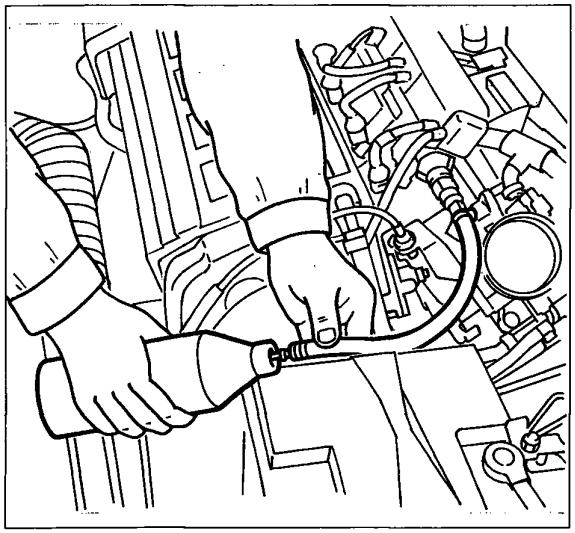
The diagnostic equipment must be used to check the ignition advance angles at the different speeds.



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3N53GJ02

## CHECKS ON FUEL SUPPLY CIRCUIT

*THESE OPERATIONS SHOULD BE CARRIED OUT IN THE PRESENCE OF A SUITABLE VAPOUR PURIFICATION AND EXHAUST SYSTEM*

### Fuel supply circuit pressure check

Check the pressure of the system and the seal of the fuel system, as described below, using equipment 1860955000, fitted with two adapators which should be constructed as described below:
- adapator (A) use a new type rapid attachment female terminal and a length of pipe contained in Kit no. 1860955003 and an old type rapid attachment male terminal contained in Kit no. 1860955001;
- adapator (B) use a new type rapid attachment male terminal and a length of pipe contained in Kit no. 1860955003 and an old type rapid attachment male terminal contained in Kit no. 1860955001;

Configure the adapators as illustrated in the diagram.

*The arrow indicates the side to be inserted in the test equipment 1860955000 (pressure gauge)*

### Draining supply system fuel pressure

The fuel supply circuit is kept at a constant pressure of around 3.2 bar, even with the engine switched off; therefore, before carrying out operations on the supply pipe the pressure must be drained from the system, using adaptor no. 1870684000 and a special container to collect the excess fuel in.
Proceed as described below:
- Remove the inlet hose from the butterfly casing;
- Remove the protective cover from the attachment on the fuel manifold;
- introduce the male terminal of the adapator inside the container and fit the rapid connector to the attachment on the fuel manifold, as illustrated in the diagram; in this way, the small amount of excess fuel, which produces pressure, will be drained into the container and it will be possible to carry out the procedure for checking the fuel supply system.
- disconnect the adaptor and refit the protective cover.

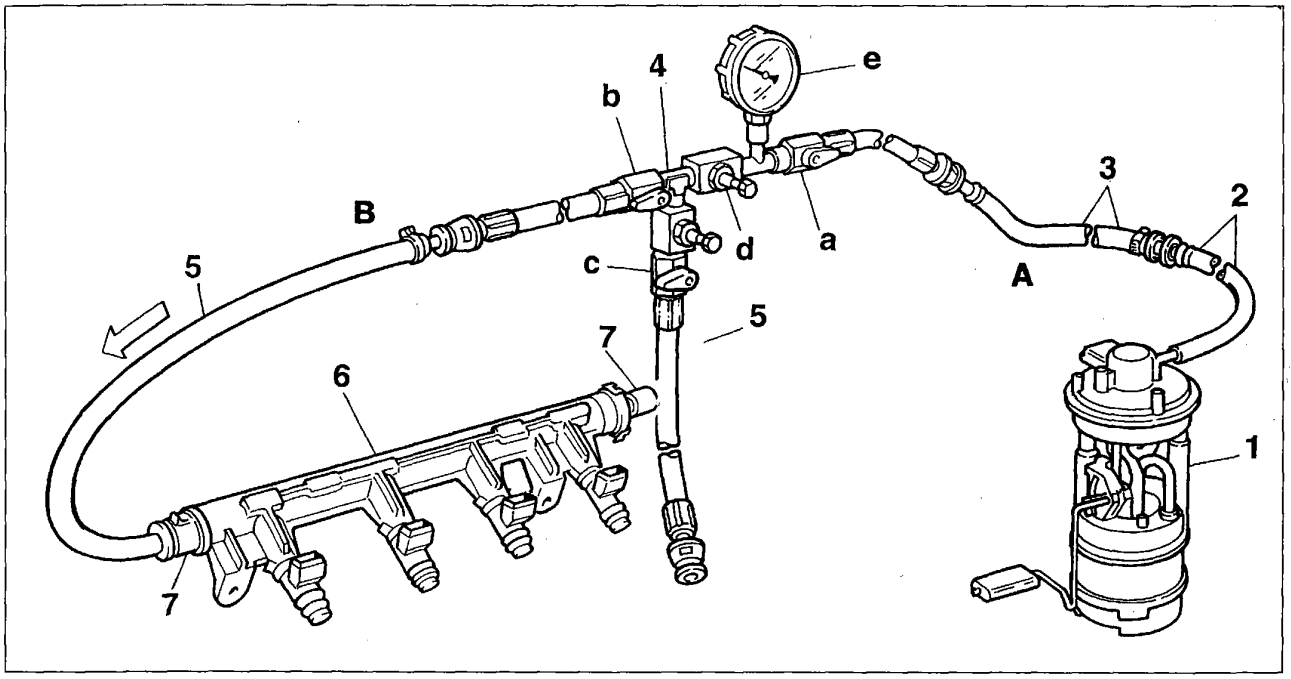


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# 10.

## Checking fuel supply circuit pressure

Prepare the test equipment 1860955000, using the adapators constructed previously and fitted as illustrated in the diagram below, with ball valves (a), (b) and (d) in the fully open position and valve (c) in the closed position.




3N54GJ01

1. Complete electric pump
2. Fuel supply pipe
3. Adapator (A)
4. Test equipment No. 1860955000
5. Adapator (B)
6. Fuel manifold
7. Rapid attachment connector on manifold

After having discharged the pressure, remove the end of the fuel supply pipe (2) from the rapid connector (7) on the manifold, following the instructions on the previous pages, connect it to the adapator (A) female connector, connect the new male end of the adapator (B) to the rapid connector on the fuel manifold (7) and check that the connectors are correctly engaged.
Turn the ignition key to the ON position and check, on the gauge (e), that, after increasing to around 3.5 bar, the pressure then settles down at round 3.2 bar (the fall in pressure is due to the fact that if the engine is not started up, after the pump has been running for several seconds, it cuts out).
If the decrease in pressure is more than the values mentioned above, check the seal of the section of the system upstream of the fuel manifold and check the seal of the injectors, proceeding as described below.

## Checking fuel supply pipe seal

Keep the test equipment as described in the previous paragraph, close valve (b), keeping valve (c) closed and valve (a) in the fully open position.
Turn the ignition key to the ON position and check, on the pressure gauge (e) that, after having increased to around 3.5 bar, the pressure settles down at around 3.2 bar (this decrease in pressure is due to the fact that if the engine is not started up, after operating for several seconds, the pump cuts out).

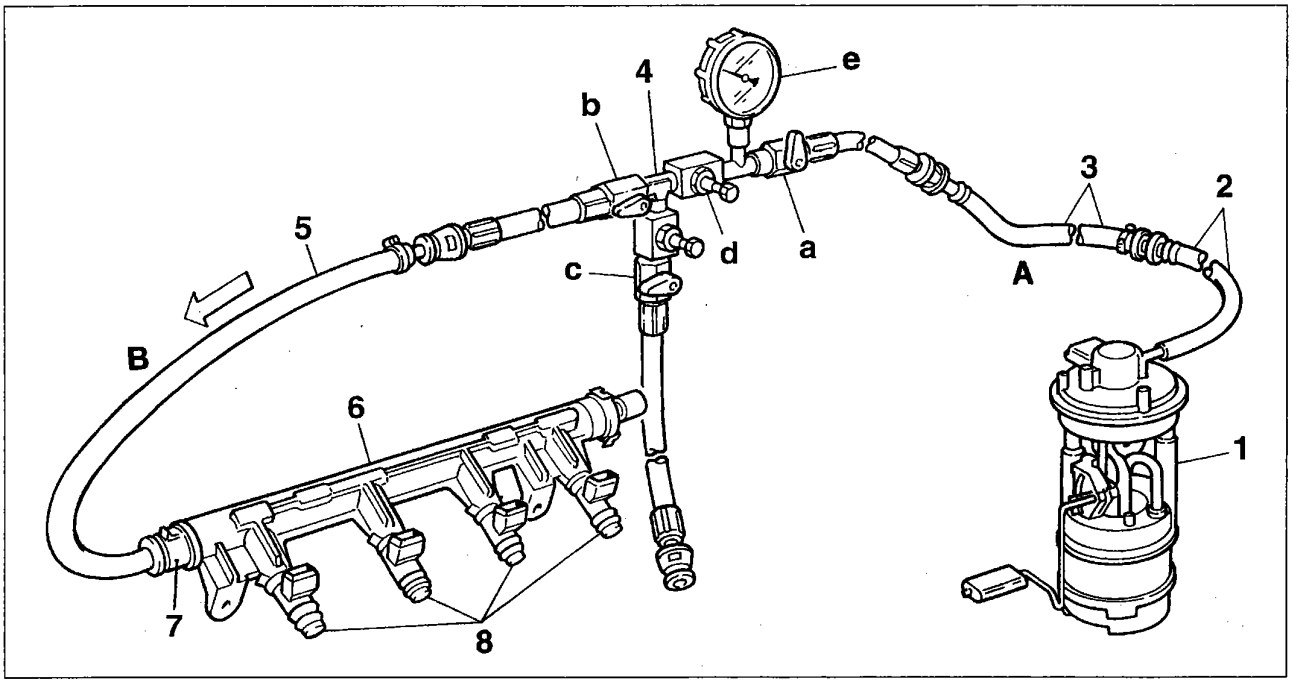


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### Checking the injector seal

If there is a decrease in pressure beyond the figures given above, check the seal of the section of the system upstream of the manifold and, if there are no leaks or damage to the fuel supply pipe, replace the electric fuel pump assembly because, as described in the paragraph dealing with the fuel pump, the pressure regulator is housed in the same unit and CANNOT be replaced.
If, after having repeated the check, the pressure exceeds the recommended figure and is considerably higher, replace the electric fuel pump because there are operating faults with the pressure regulator which is housed inside it.

### Checking the seal of the injectors




3N55GJ01

1. Complete electric pump
2. Fuel supply pipe
3. Adaptor (A)
4. Test equipment No. 1860955000
5. Adapator (B)
6. Fuel manifold
7. Rapid connector on the manifold
8. Injectors

Keep the test equipment as described in the previous paragraph, place valve (b) in the fully open position, keeping valve (c) closed and valve (a) in the fully open position.
Turn the ignition key to the ON position and observe on the pressure gauge (e), that the pressure, after having increased to around 3.5 bar, settles down at a pressure of around 3.2 bar, then close valve (a) and check that the pressure remains constant for at least a minute; if this is not the case, then one or more of the injectors is leaking.

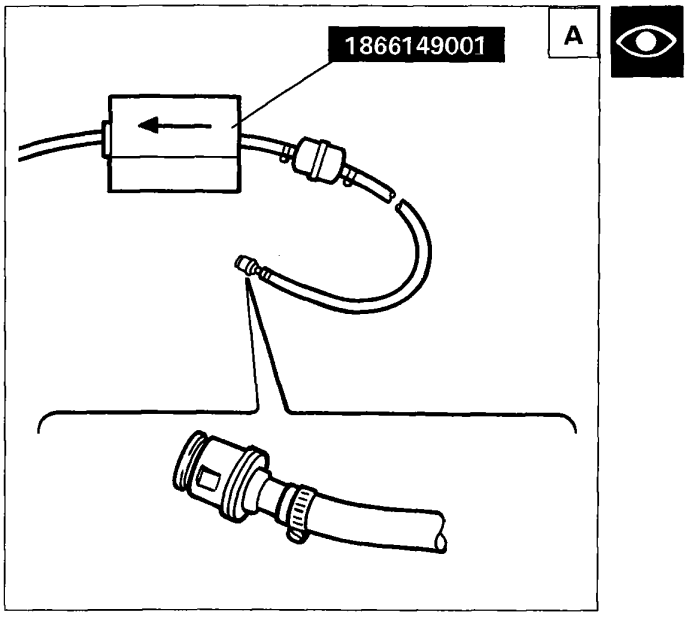
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## Removing test equipment

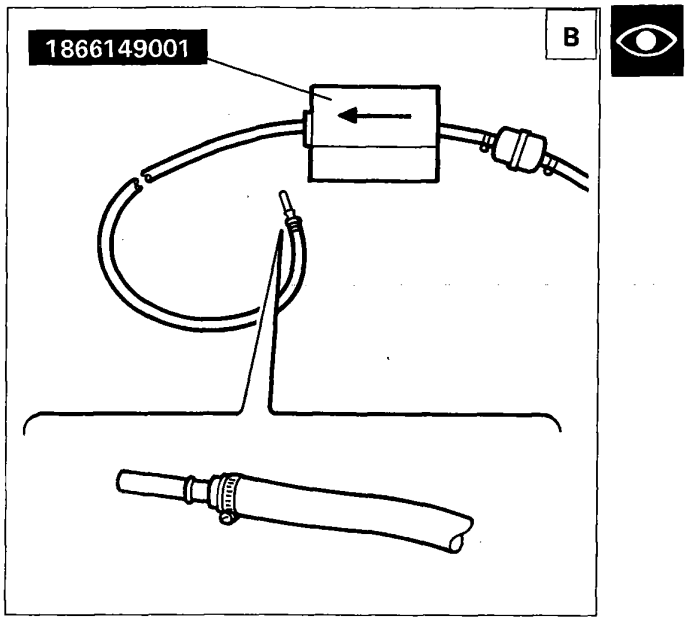
Remove the test equipment 1860955000 with the ignition key in the OFF position, proceeding as described below:
- introduce the end of the pipe connected to the valve (c) into a suitable container;
- open the valve (c) and drain the excess fuel into the container;
- keep the pipe in the container and disconnect the end of the supply pipe from the female connector for adapator (A) keeping the connector upwards;
- let the fuel in the pipes flow into the container;
- disconnect the terminal of adapator (B) from the connector on the fuel manifold and let the residual fuel flow from the pipes into the container;
- reconnect the fuel supply pipe to the fuel manifold.




3N56GJ01

Check the fuel consumption using the FLOWTRONIC equipment 1866149001

To carry out the test, the equipment should be configured with the connectors shown in the diagrams:
A. supply pipe side
B. fuel manifold side
If this is not the case, make the adjustment, proceeding as described below:
- cut the terminal on the inlet pipe for the FLOWTRONIC equipment and replace it with a female rapid connector (1) contained in Kit No. 1860955003, as illustrated in figure A;




3N56GJ02

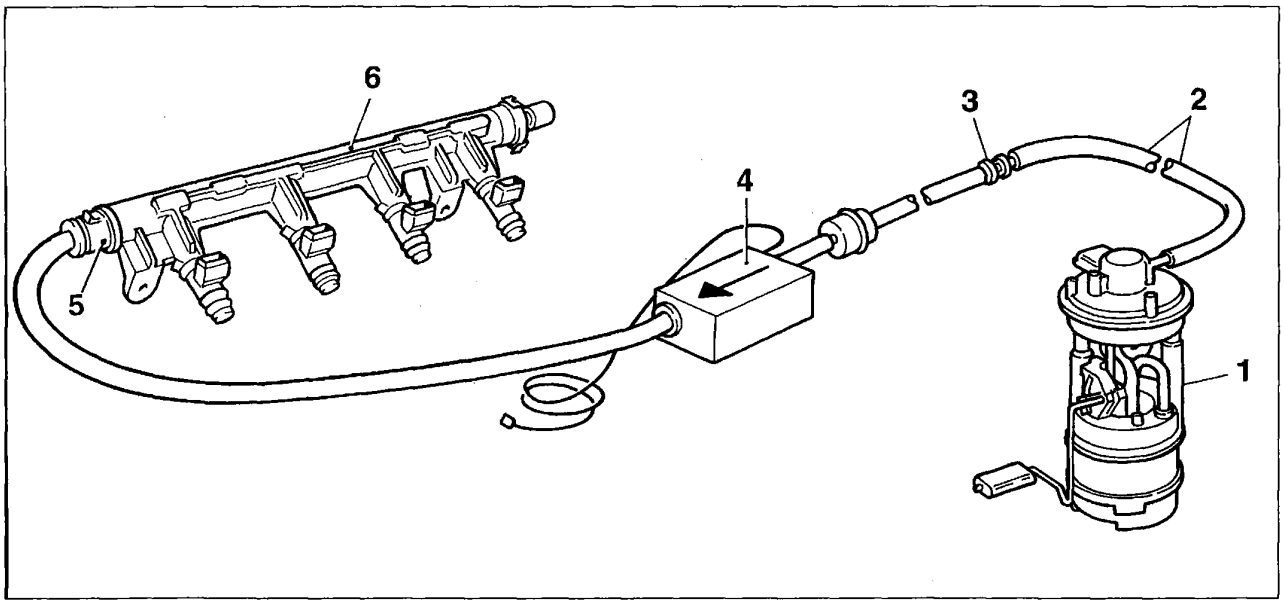
- cut the terminal on the outlet pipe for the FLOWTRONIC equipment and replace it with a male connecto (2) contained in Kit No. 1860955003, as illustrated in figure B.

*The connectors removed should be recovered and kept for any future connections*



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- drain the fuel pressure inside the supply pipe and disconnect the pipe from the fuel manifold, acting as described in the previous paragraphs;
- attach the end of the supply pipe to the female rapid connector for the FLOWTRONIC equipment and the male connector to the rapid connector on the fuel manifold;
- position the equipment in the engine compartment, place the connecting electrical cable inside the vehicle and connect the actual equipment as described in the instructions which come with the tool.
- proceed with checking the consumption following he 93/116 CE standards and check that the figures correspond with those in section 00 - Technical Data.




3N57GJ01

1. Complete electric pump
2. Fuel supply pipe
3. Female rapid connector
4. FLOWTRONIC equipment
5. Male terminal
6. Fuel manifold

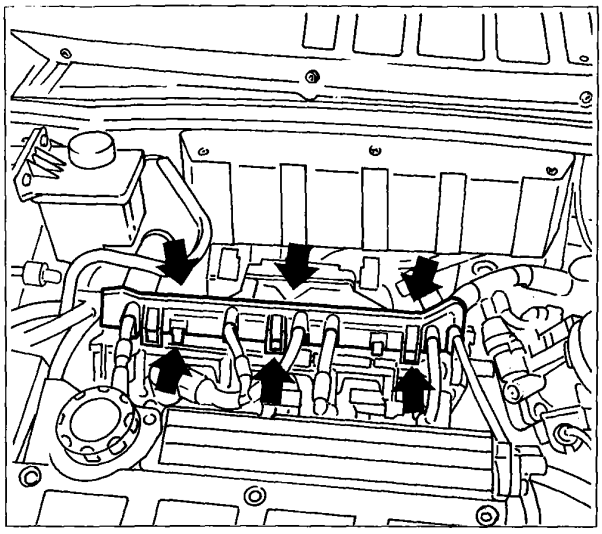
- carry out the road fuel consumption test in accordance with directive 93/116 CE (litres per 100 km):
- URBAN CYCLE - this includes a cold start followed by a varied, simulated urban cycle;
  EXTRA-URBAN CYCLE - this includes frequent acceleration, in all gears, simulating the normal out of town usage of the vehicle; the speed varies between 0 and 120 km/h;
  AVERAGE COMBINED CONSUMPTION - this incudes 33% of the urban cycle and 67% of the extra-urban cycle;
- check that the figures measured correspond to those in the section "Introduction and Technical Data".

NOTE *The type of route, traffic cnditions, driving style, weather conditions, trim level/accessories, presence of a roof rack, presece of special equipment and the state of the vehicle in general, can lead to different fuel consumption figures from those established during the above mentioned procedures.*

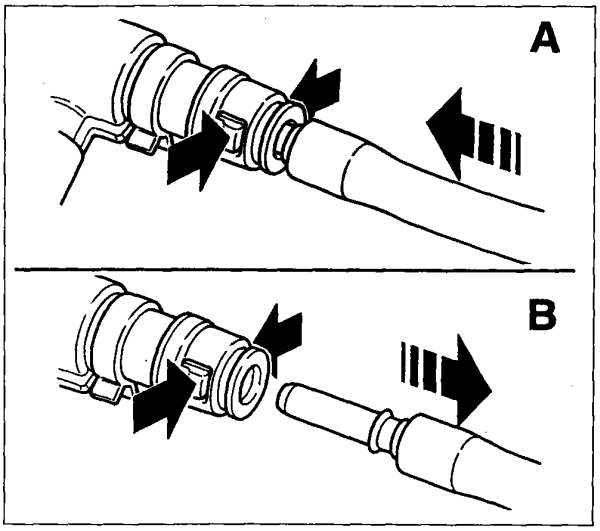


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# 10.



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3N61GJ02

## FUEL MANIFOLD AND INJECTORS

*Before removing the manifold, drain the internal pressure following the instructions at the beginning of this chapter.*

Proceed with removing the manifold, as follows:

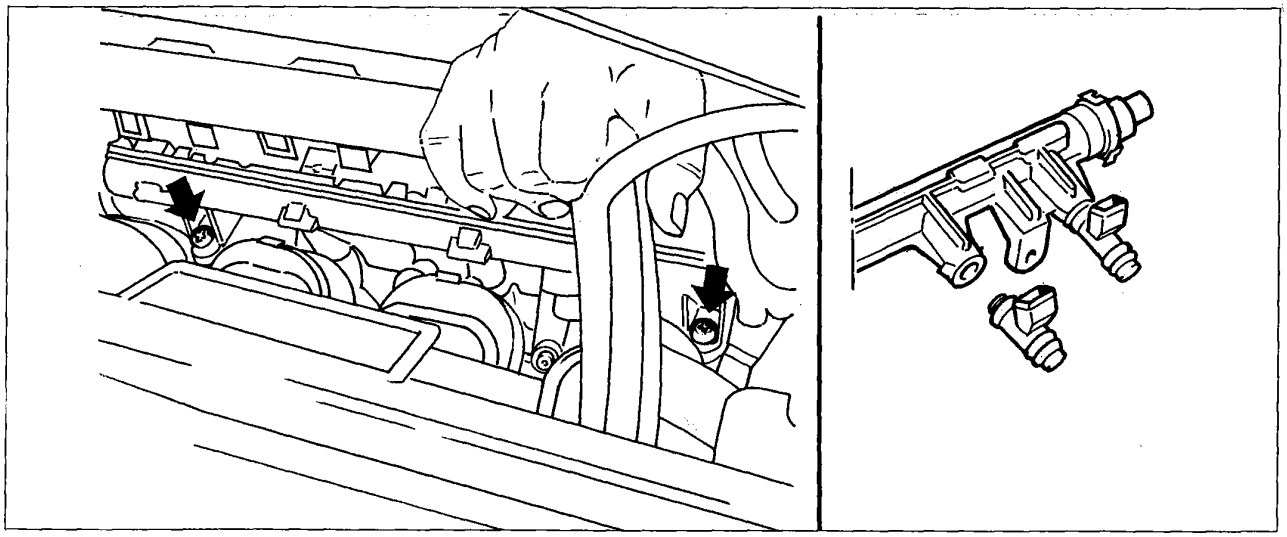
- release the front and rear springs (arrow) attaching the cable duct to the manifold;
- disconnect the electrical connections from the injectors and from the phase transformer and move the duct, released previously, aside;
- disconnect the fuel supply pipe (1) from the manifold, working in two stages:

A. press the retaining springs, at the same time pushing the end of the pipe in the direction shown to release the casing;

B. keep the springs pressed and extract the end from the manifold;

- undo the two bolts (arrow) fixing the manifold and remove it.

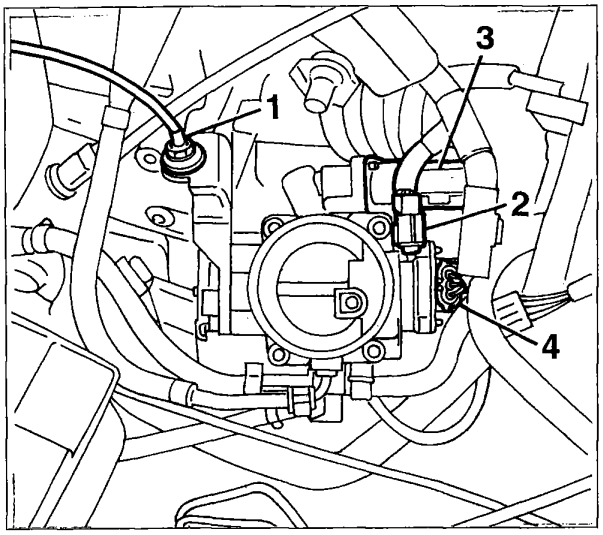
The injectors do not have clips: to detach them simply remove them from their housing (see detail).



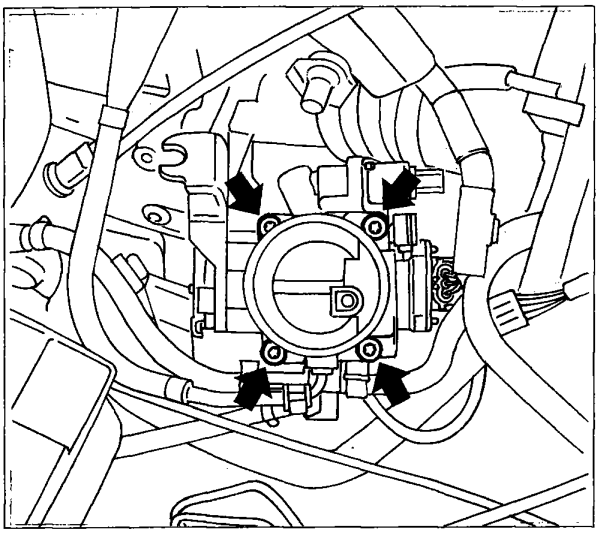
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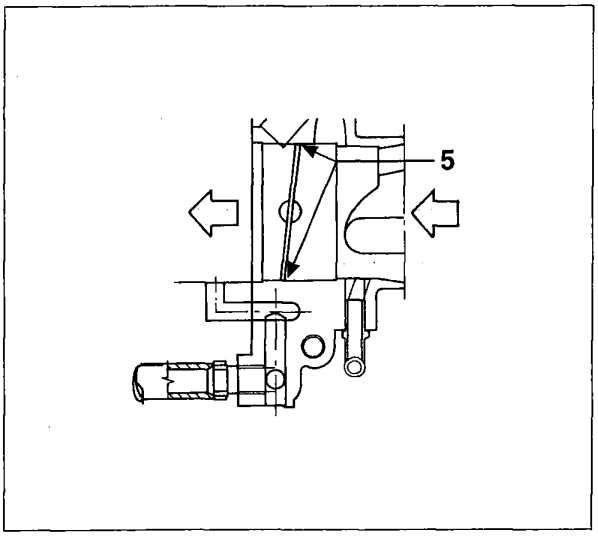
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## BUTTERFLY CASING

**NOTE** *The butterfly casing and the flow meter are incorporated in a single unit.*

### Removing-refitting

Proceed with the removal of the butterfly casing, as follows:

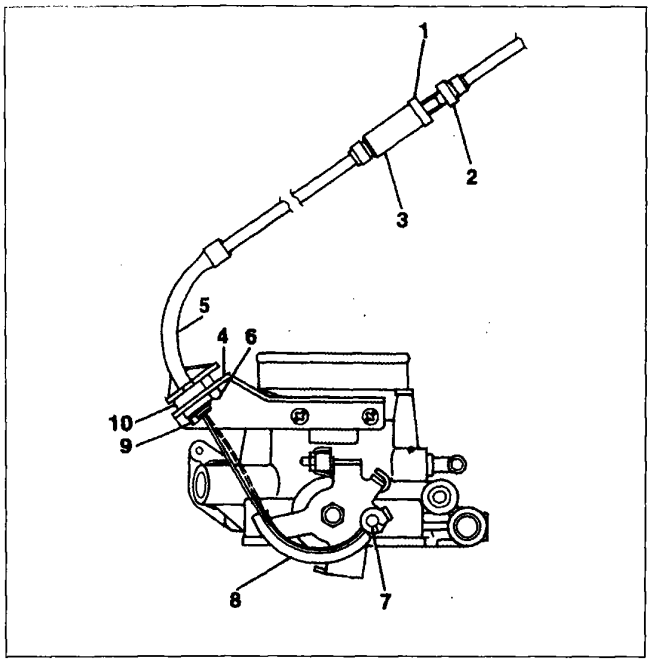
- remove the inlet hose from the butterfly casing, loosening the retaining bands;
- remove the accelerator cable (1), completely undoing the connector on the adjustment bracket and releasing the cable from the lever on the butterfly casing;
- disconnect the electrical connectors from the butterfly position sensor (2), the idle adjustment solenoid valve (3) and the air flow meter (4);
- remove both connecting pipes from the PCV valve;
- undo the four bolts (arrow) fixing the butterfly casing to the inlet manifold;
- remove the coolant connecting pipes from the inlet and outlet pipes, sealing them suitably.

**NOTE** *Do not remove the layer of molybdenum disulphide applied to the edge of the butterfly.*



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# 10.




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## ACCELERATOR CONTROL CABLE

### Removing

- Working from inside the vehicle, disconnect the accelerator cable from the attachment on the pedal.
- Loosen the accelerator cable, acting on the adjustment screw (2), then release the end of the cable (7) from the pulley (8).
- Remove the clip (9) and remove the cable from the mounting bracket, then remove the accelerator cable.

### Refitting

- Fit the rubber mounting (10) in the special housing in the bracket (4).
- Insert the flexible cable (5) in the rubber mounting (10), positioning it so that the reference pin (6) on the cable engages in the special opening in the bracket (4).
- Wind the accelerator cable around the pulley (8) and insert the terminal (7) in the special housing.
- Insert the clip (9) into the groove at the end of the cable (5).
- Reconnect the accelerator cable to the attachment on the pedal.

### Adjustment

- Working on the adjustment nut (2), adjust the accelerator cable clearance so that, with the pedal released, the butterfly is completed closed (pulley in end of travel position against the adjustment screw) and the clearance (4) at the cable is about 5 mm. At the end of the adjustment, tighten the ring nut (1) against the dust cover (3), by hand.
- If the accelerator cable is being replaced, connect the diagnostic equipment to the special socket and check that, with the pedal fully depressed, the butterfly opening angle is between 80° and 84° (98-99%). If the value measured does not correspond to the recommended figures, regulate the adjustment screw on the accelerator pedal to adjust the travel.



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## BOSCH MOTRONIC ME 3.1 M.P.I. INTEGRATED INJECTION/IGNITION SYSTEM

### Introduction

The Bosch Motronic system fitted on the 1998 5 cylinder 20 valve version belongs to the category of static advance, inductive discharge, digital electronic ignition systems integrated with phased, sequential type electronic injection systems.
This system has one electronic control unit, a single set of wiring and one set of joint sensors.
Its function is to inject the exact quantity of petrol, into the engine inlet manifold, upstream of the inlet valves, designed to mix with the air introduced into the cylinder in order to obtain the correct mixture strength.
The ME 3.1 Motronic system guarantees efficient operation giving optimum performance and consumption and a reduction in harmful emissions through a prompt response to the different engine operating conditions.

### General description of the injection system

There are basically two essential conditions which must always be met for the smooth running of ignition systems when preparing the air/fuel mixture, namely:

1. the metering (air/fuel ratio) which must be kept as constant as possible and close to the stoichiometric value to ensure the necessary speed of combustion avoiding pointless fuel consumption;
2. the mixture must be composed of petrol vapours dispersed as finely and evenly as possible in the air.

As far as the optimum metering, on the other hand, is concerned, it is calculated by the control unit following these measurements:

- exact quantity of intake air via the flow meter;
- engine rotation speed via the rpm sensor;
- power requirement via the accelerator pedal potentiometer;
- engine coolant temperature via the sensor on the thermostat support;
- measurement of the exhaust gas oxygen content through the Lambda sensor.

This information is processed by a micro-calculator inside the injection/ignition electronic control unit which determines the basic injection time through experimentally obtained values which are stored in a special memory in the above mentioned control unit.

### General description of the ignition system

The ignition system is the static advance inductive discharge type (i.e. there is no high tension distributor) with the power modules inside the electronic control unit.

The system has a single coil for each spark plug; the advantages of this solution are:

- less electrical overload
- guarantee of constant discharge at each spark plug

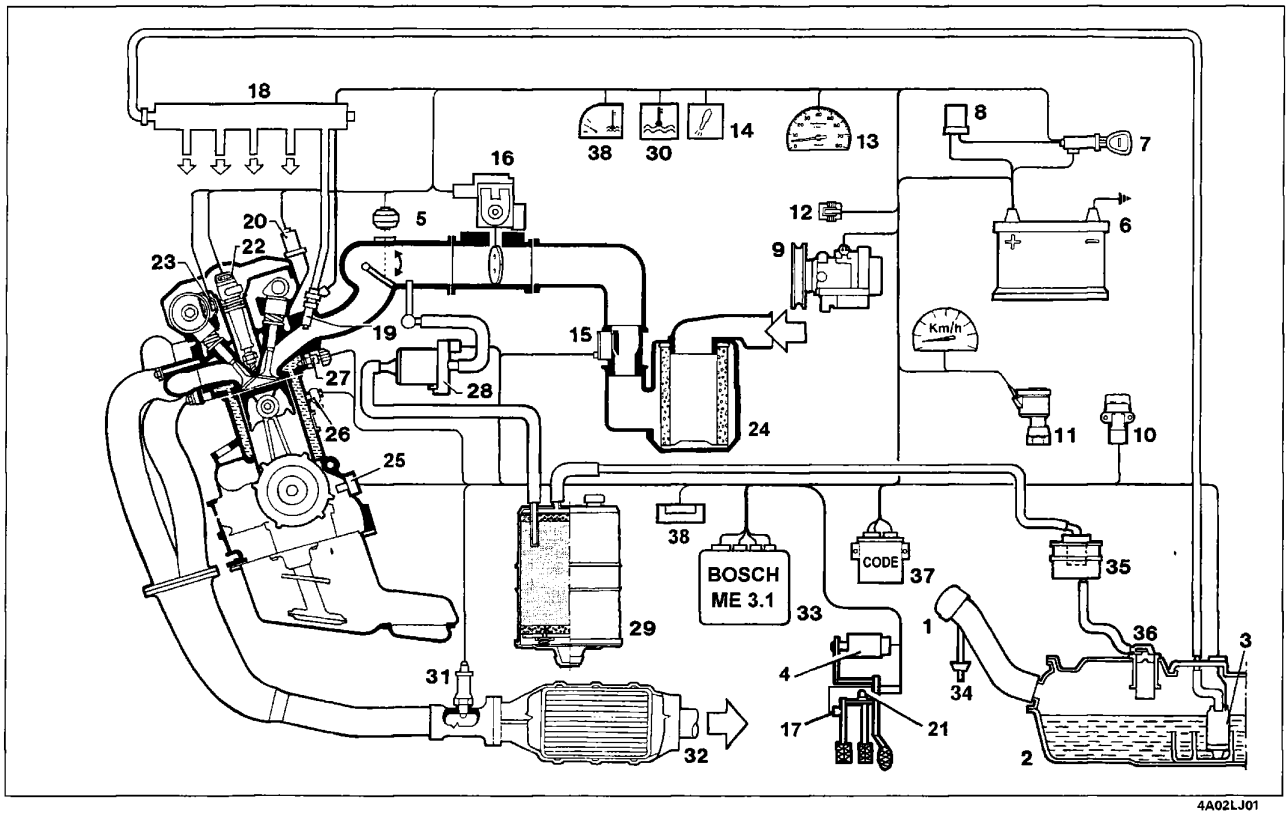
There is a map in the electronic control unit memory containing the entire series of optimum ignition advances for the engine operating range according to the engine speed and load conditions.
In the case of detonation it is possible to selectively delay the ignition for the individual cylinder, recognized by the combination of figures transmitted by the detonation sensors and the timing sensor.

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# 10.

## INJECTION/IGNITION SYSTEM FUNCTIONAL DIAGRAM




1. Fuel tank filler cap
2. Fuel tank
3. Electric fuel pump with filter and pressure regulator
4. Accelerator pedal potentiomer
5. Variable geometry manifold solenoid valve
6. Battery
7. Ignition switch
8. System relay feed
9. Climate control compressor
10. Inertia switch
11. Vehicle speed sensor
12. Diagnostic socket
13. Rev counter
14. System failure warning light
15. Air flow meter
16. Butterfly casing electronic actuator
17. Clutch pedal switch
18. Fuel manifold
19. Injectors
20. Phase transformer solenoid valve
21. Brake pedal switch
22. Ignition coils
23. Engine timing sensor
24. Air filter
25. Engine rpm sensor
26. Detonation sensors
27. Coolant temperature sensor
28. Fuel vapour solenoid valve
29. Charcoal filter
30. Coolant overheating warning light
31. Lambda sensor
32. Catalytic silencer
33. Injection/ignition control unit
34. Safety valve
35. Fuel vapour separator
36. Multi-purpose valve
37. Fiat CODE control unit
38. Coolant temperature gauge



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These values are obtained experimentally by means of a long series of practical tests carried out on prototypes at the engine test bench to identify the advances which give the best possible compromise between the conflicting requirements of maximum power and minimum consumption and harmful exhaust emissions.
The optimum advances have then been stored in the systm control unit memory. Whilst the engine is running, the control unti is constantly informed of the (engine) speed and load conditions and, on this basis, it "selects" the optimum advance from its memory for striking the spark at the spark plug for the cylinder in the explosion stroke with the optimum advance.
In addition, the control unit corrects this value according to further factors such as the engine coolant temperature, the intake air temperature, detonation and the butterfly valve position so that the ignition point is always optimum.
The information required by the control unit for operating the single coils is transmitted by means of electrical signals from the following sensors:

a. **An rpm sensor** which produces an alternating, single phase signal whose frequency indicates the engine speed.

b. **An air flow meter** with a temperature sensor which, according to the quantity/temperature of the air drawn in by the engine, transforms these values into electrical signals, sending them to the electronic control unit.

c. **Two detonation sensors** which, located on the top part of the cylinder block/crankcase, one between cylinders 1 and 2 and the other between cylinders 4 and 5, allow the control unit to recognize the cylinder where there is detonation (or the onset of detonation) and only correct the ignition advance for the spark plug of the cylinder concerned.

d. **An accelerator pedal potentiometer** which transforms the angular value of the actual pedal into an electrical signal allowing the control unit to recognize minimum, partial and full load conditions.

### Injection/ignition system functions

In addition to electronically controlling the moment of ignition and the air flow rate during idling, in order to allow the engine to run smoothly as the ambient parameters and loads applied vary, the control unit must control and manage the injection so that the stoichiometric (air/fuel) ratio is always within the optimum value.
The electronic control unit establishes the "time" for operating the injectors using a relatively simple rule which can be summarized as follows.
Taking the physical properties of the fuel (viscosity and density) and the difference in pressure between the pressure of the fuel and the pressure in the inlet manifolds as constant, the quantity of fuel injected only depends on the "opening time" of the injector.

The injection/ignition system basically performs the following functions:

- adjusting the injection times;
- adjusting the ignition advances;
- controlling cold starting;
- controlling enrichment during acceleration;
- fuel cut-off during overrun;
- controlling the engine idle speed;
- restricting the maximum number of revs;
- controlling combustion via the Lambda sensor;
- fuel vapour recovery;
- detonation control;
- phase transformer control;
- inlet manifold control;
- system self-adjustment;
- autodiagnosis;
- connection with engine immobilizer device (Fiat CODE);
- management of the climate control system;
- management of the radiator fans.

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# 10.

## SYSTEM MANAGEMENT STRATEGIES

### Adjustment of injection times

Digital technology has made it possible to ensure optimum consumption and performance using programmed maps, stored inside the control unit memory, according to the engine speed and load conditions.
The control unit operates the injectors with great speed and precision, calculating the opening time on the basis of the engine load (number of revs and air flow rate), also taking into account the battery voltage and the temperature of the engine coolant.
The injection is sequential and phased for each cylinder (the moment of injection is not simultaneous for all cylinders) and takes place at the optimum injection point.

### Ignition advance adjustment

Thanks to a map stored in its memory, the control unit is capable of calculating the advance according to the engine load (minimum, partial, full - on the basis fo the engine speed and air flow rate), the temperature of the intake air and the temperature of the engine coolant.
The ignition can be selectively delayed at the cylinder as required, recognized by means of the combination of values recorded by the cam angle and detonation sensors.

### Controlling cold starting

Under these circumstances there is a natural weakening of the mixture as a result of the poor turbulence of the particles of fuel at low temperature and reduced evaporation and condensation on the internal walls of the inlet manifold, all of which is exacerbated by the increased viscosity of the lubricant oil.
The electronic control unit recognizes this condition and corrects the injection time according to the signal for the coolant temperature, the intake air temperature, the battery voltage and the engine speed.
The ignition advance is only dependent on the number of revs and the temperature of the engine coolant.
During cold starting, the control unit carries out an initial simultaneous injection for all the injectors (full group) and, after recognizing the reference on on the flywheel, it switches to normal sequential, phased operation. Warm starting takes place immediately in a sequential, phased manner.

### Controlling the enrichment of the mixture during acceleration

The control unit detects the request for acceleration from the signal from the accelerator pedal potentiometer and consequently increaes the injection times and modifies the opening of the butterfly valve to reach the number of revs required quickly.
If, following an acceleration request, the variation in the signal from the air flow meter exceeds a pre-set increase, the control unit, not only adapts the injection to the new requirement, but it also increases it further for several seconds to improve the responsiveness.

### Fuel cut-off during overrun

When the accelerator pedal is released and beyond a pre-set engine rpm level, the injection control unit cuts off the supply to the injectors.
If there is no supply, the number of revs will start to decrease at a rate dependent on the vehicle driving conditions.
Before the idle speed is reached, the dynamics of the decreaes in the engine revs is verified.
If this is above a certain value, the fuel supply is partly restored according to a logic which involves the "soft accompaniment of the engine" during idling.



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Having reached this condition, the normal functions for idling and cut-off during overrun are only reactivated when the fuel cut-off level is exceeded to ensure that the engine runs smoothly. The levels for restoring the supply and fuel cut-off vary according to the temperature of the engine.
Another fuel cut-off logic is developed in the control unit which intervenes in partial deceleration conditions, i.e. when the engine load conditions decrease.
This function is only activated if the new condition persists for a pre-set time and after the ignition advance angle has been adapted to the new situation.

### Engine idle speed control

The control unit recognizes the "idle" condition (accelerator pedal released) from the signal supplied by the accelerator pedal potentiometer and according to the signals from the brake and clutch pedal switches and the electrical consumers switched on (climate control and radiator fan) and operates the butterfly valve motor to produce an idle speed of 700\26150 rpm.
The idle correction is also carried out through the variation of the ignition angle since it has a more prompt effect.
The correct self-learning of the minimum and maximum butterfly opening positions is essential for the effective control of the idle speed; it should therefore be carried out at least once in production and every time the engine control unit or the motorized butterfly casing is replaced.
The self-adjustment function makes it possible to adapt the idle adjustment to any variations in the idle management components.

### Restricting the maximum number of revs (protection outside of revs)

When the engine speed exceeds 6,800 rpm, the electronic control unit reduces the operating times for the injectors to avoid overloading the engine also protecting it outside of revs.
If the engine speed exceeds 7,000 rpm, the control unit activates the "fuel cut-off" strategy, restoring the operation of the injectors when the speed goes below a certain level.

### Controlling combustion via the Lambda sensor

The Lambda sensor informs the control unit of the quantity of oxygen present at the exhaust and therefore the correct air/fuel metering by means of a two stage voltage signal corresponding to a poor and rich mixture.
To produce the ideal mixture for the operation of the three-way catalyzer with minimal emissions, the petrol injected must correspond to a pre-set (stoichiometric ratio) with the intake air, measured by the unitary value of the Lambda parameter (=1); if the mixture is lean it is > 1, if it is rich is it < 1.
The Lambda sensor, in contact with the exhaust gases, produces an electrical signal whose voltage depends on the concentration of oxygen in the gases:

- if the mixture is lean (> 1), the sensor supplies a low voltage (< 200 mV) and the control unit slightly increases the quantity of petrol injected;
- if the mixture is rich (< 1), the sensor supplies a high voltage (> 800 mV) and the control unit reduces the quantity of petrol injected.

The closed-loop management of the Lambda sensor allows the control unit to keep the Lambda value very close to the theoretical unitary value, also aided by appropriate self-adjustment functions.
The control unit also manages the supply of the Lambda sensor heater. In effect, on the basis of the engine load and speed conditions, the control unit processes a forecast for the temperature of the exhaust gases and consequently controls the heater supply current, restricting it to the actual requirements dependent on the engine conditions.

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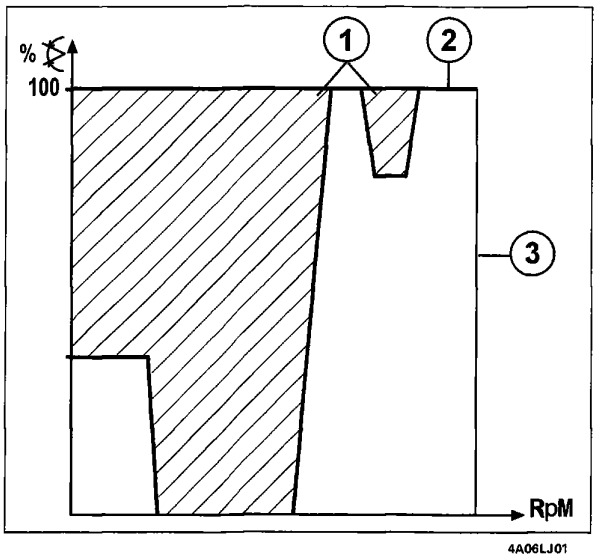
## Fuel vapour recovery

The fuel vapours (pollutant according to the regulations) are sent to an active charcoal filter and from there to the engine where they are burnt; this takes place by means of a solenoid valve which is only operated by the control unit when the engine load conditions allow correct combustion without the operation of the engine being "disturbed": in effect, the control unit compensates for this quantity of petrol entering with a reduction in the injector supply.

## Detonation control

This function has the task of detecting the presence of detonation (engine knock) by processing the signal coming from the sensors. The control unit continously compares the signals coming from the sensors with a set level which is, in turn constantly updated to take into account background noise and the ageing of the engine.
The control unit is therefore capable of detecting the presence of detonation (or the onset of detonation) and reduces the ignition advance (from 3° up to a maximum of about 9°) until the phenomenon disappears. Later on, the advance is gradually restored to the basic value.
In acceleration conditions, a higher level is used to take into account the increased noise of the engine in these circumstances. The detonation control strategy is also equipped with a self-adjustment function which memorizes the reductions in the advance which are continuously repeated to adapt the map to the various conditions in which the engine finds itself.

## Phase transformer control




1. Transformer in ON position
2. Accelerator pedal fully depressed
3. Maximum speed restriction

The control unit controls the phase transformer hydraulic actuator solenoid valve (fitted on the inlet side camshaft) via a relay.
There are two operating positions for the transformer:

A. OFF position (power, reduced engine loads and idling), corresponding to the normal camshaft fitting value;

B. ON position (torque), corresponding to an 18\272 crankshaft advance of the camshaft.

The transformer, usually in the OFF position, is switched to the ON position depending on the engine load and speed conditions, as illustrated in the diagram.
In any case, the ON position is only enabled at coolant temperatures above 40°C.

Obviously the phase transformer control operates within a hysteresis range, i.e. the level for activating the solenoid valve is always higher than that for deactivating it; this is designed to prevent balanced conditions and too rapid a progression from one timing diagram to another with obvious operating problems.

## Inlet manifold control

The control unit controls the geometry of the inlet manifolds to optimize the quantity of air drawn in by the engine.
The control unit selects short ducts for speeds above 4500 RPM and high engine loads.
In other engine operating conditions, the control unit selects the long duct configuration.



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### System self-adjustment

The control unit is equipped with a self-adjustment function which has the task of recognizing the changes which take place in the engine due to bedding in over time and the ageing of both the components and the actual engine.
These changes are memorized in the form of modifications to the basic map and are designed to adapt the operation of the system to the gradual alterations to the engine and components compared with when they were new.
This adjustment function also makes it possible to compensate for the inevitable differences (due to production tolerances) in components which are replaced. This allows optimum results in all vehicles without special regulation and control operations.

### Autodiagnosis

The ME 3.1 injection/ignition system also has an "autodiagnostic" function which memorizes any irregularities with the sensors and actuators, facilitating their identification and correction. A fault is signalled by the special failure warning light in the instrument panel.

### Connection with engine immobilizer device (Fiat CODE)

To improve protection against theft attempts, the vehicle is equipped with an engine immobilizer (Fiat CODE) which only allows the injection/ignition system to be activated by means of an electronic code.

Each time the key is turned to the OFF position, the Fiat CODE system completely deactivates the injection/ignition control unit.

When the ignition key is turned from OFF to ON, the following operations take place in the order given:

1. The injection/ignition control unit sends the Fiat CODE control unit a request for the secret code to deactivate the immobilizer function.
2. The Fiat CODE control unit responds by only sending the secret code after having, in turn, received the recognition code transmitted by the ignition key which contains a special transponder.
3. The recognition of the secret code allows the deactivation of the immobilizer function and the injection/ignition control unit can activate the normal system mangement programme.

A special two-way serial line allows the exchange of data between the injection/ignition control unit and the Fiat CODE control unit.
If there is a failure in the Fiat CODE system it is still possible to start up the vehicle using the emergency procedure.



*Given the presence of the Fiat CODE system* DO NOT *carry out tests using another injection/ignition control unit during the fault diagnosis and/or functional tests. Under these circumstances, the Fiat CODE control unit would transfer the (unrecognized) code to the test control unit which could then no longer be used on any other vehicles.*



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# 10.

## Management of the climate control system

The injection/ignition control unit is functionally connected to the climate control system as follows:

1. it receives the request to engage the compressor from the climate control unit via pin F6 and operates the various interventions (additional air);
2. it gives the go ahead to engage the compressor via pin F13 when the strategy conditions are verified;
3. it receives information on the four stage pressure switch status from pins F9 and F41 and operates the interventions (operation of radiator fan).

As far as point 1 is concerned, if the engine is idling, the control unit increases the flow rate of the air passing through the motorized butterfly casing before the compressor is switched on and, conversely, it returns the actual to the normal position after the compressor is switched off.

As far as point 2, on the other hand, is concerned, the control unit automatically switches off the compressor:

- for several seconds (timed disengagement):
  - in high engine power requirement conditions (fierce acceleration);
  - during engine take-off;
- as long as the following critical conditions persist:
  - at engine coolant temperatures above a certain level;
  - at engine speeds above or below a certain level.

## Management of the radiator fan

The control unit directly controls the operation of the radiator fan according to the temperature of the engine coolant and the engagement of the climate control system.
The fan comes on when the temperature exceeds 98°C (1st speed) and 101°C (2nd speed). It is switched off with a hysteresis of 2°C below the temperature threshold.

## AIR INTAKE CIRCUIT

The 1998 5 cylinder 20 valve version is equipped with a special air intake system. The manifold consists of two half shells and an internal rocker element (module) which, operated by a special pneumatic actuator, can assume two positions producing different inlet manifold lengths (variable geometry).

In this way it is possible to create five long (torque) ducts or five short (power) ducts.

The two different length ducts operate alternately allowing maximum volumetric efficiency at different speeds.

By selecting the appropriate length inlet manifold it is possible to ensure that the fluctuations in the column of gas entering are phased with the movement of the valve to increaes the inertia effect of the gaseous mass in the cylinder.

This makes it possible to achieve a better degree of filling than usual.

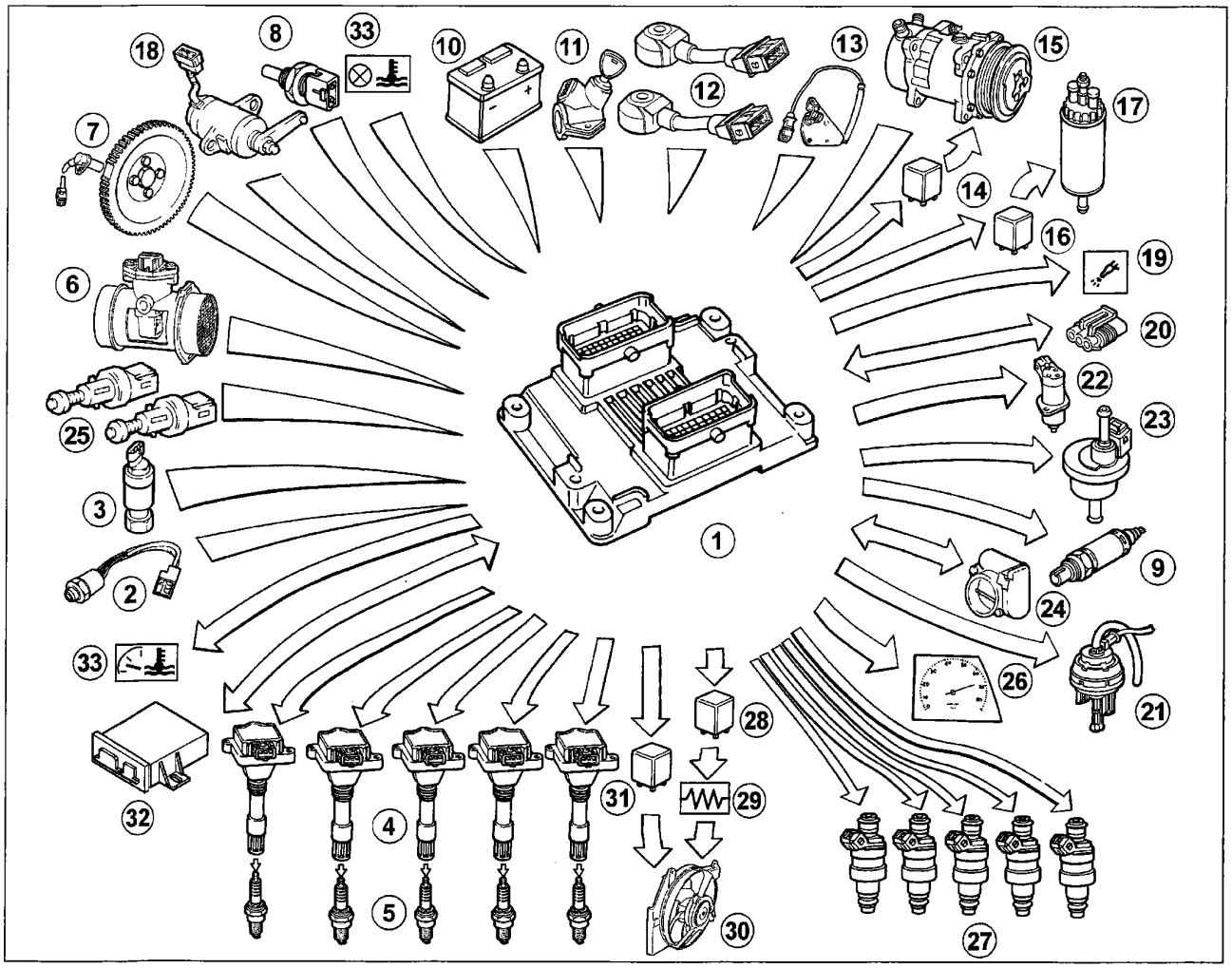
Obviously, the device works within a hysteresis range, i.e. the shifts from the "power" manifold and viceversa do not always take place at the same engine speed.

This is to avoid the possibility of balanced conditions being created and too rapid a succession of movements from one length to another with obvious operating problems.



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## DIAGRAM SHOWING INFORMATION ENTERING/LEAVING THE INJECTION/IGNITION SYSTEM CONTROL UNIT AND SENSORS/ACTUATORS




1. Electronic control unit
2. Four stage pressure switch
3. Speedometer sensor
4. Coils
5. Spark plugs
6. Flow meter
7. Rpm sensor
8. Coolant temperature sensor
9. Lambda sensor
10. Battery
11. Ignition switch
12. Detonation sensors
13. Timing sensor
14. Air conditioning compressor relay
15. Climate control system
16. Electric fuel pump relay
17. Electric fuel pump
18. Accelerator pedal potentiometer
19. System failure warning light
20. Diagnostic socket
21. Variable geometry inlet manifold solenoid valve
22. Phase transformer solenoid valve
23. Fuel vapour solenoid valve
24. Butterfly casing actuator
25. Brake and clutch pedal switch
26. Rev counter signal
27. Injectors
28. Radiator fan 1st speed relay
29. Radiator fan 1st speed resistance
30. Radiator fan
31. Radiator fan 2nd speed relay
32. Fiat CODE control unit
33. Engine coolant temperature gauge

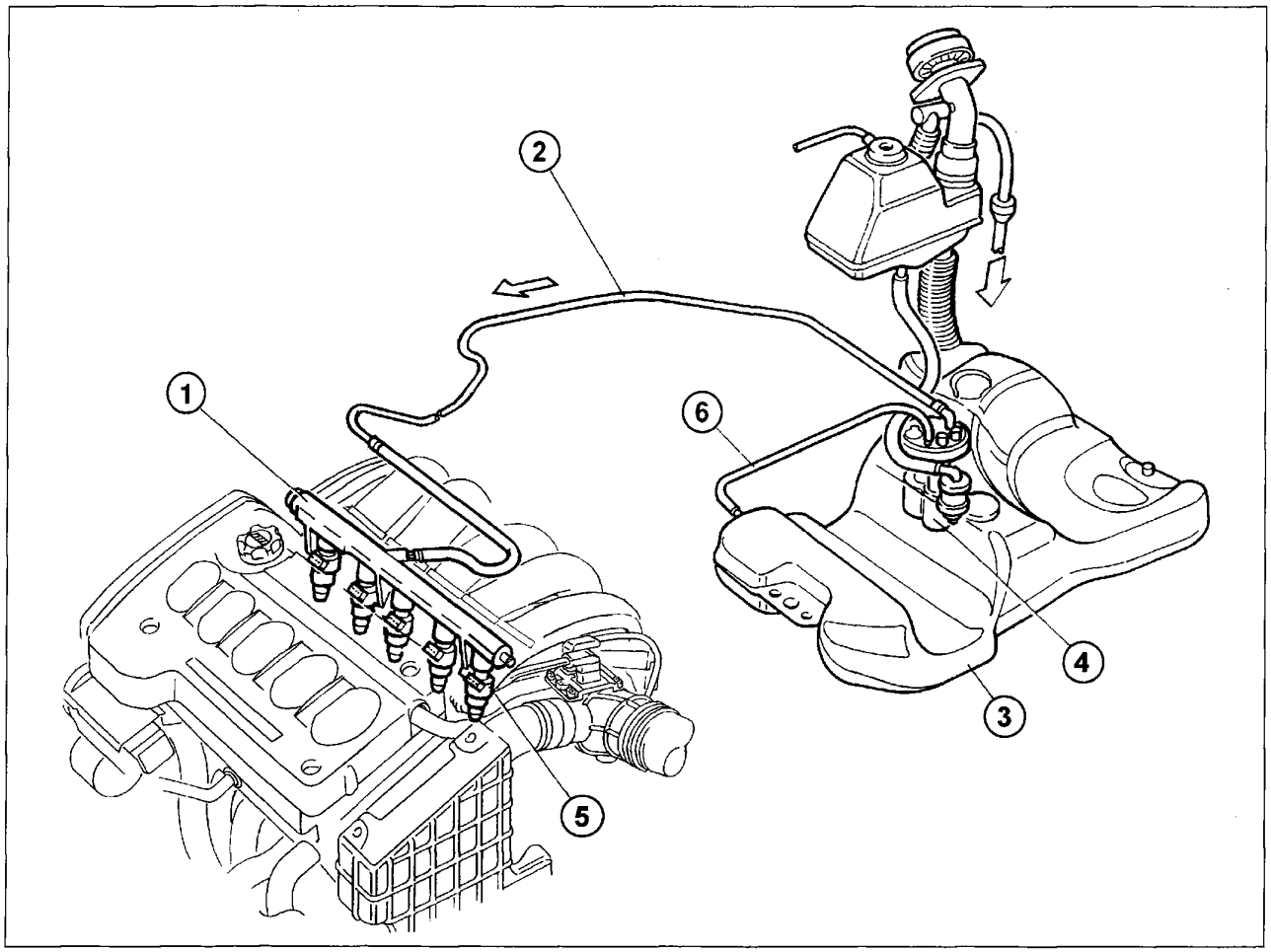
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# 10.

## FUEL SUPPLY CIRCUIT DIAGRAM




4A10LJ01

1. Fuel supply manifold
2. Fuel supply pipe to the injectors
3. Tank
4. Electric fuel pump with filter and pressure regulator
5. Injectors
6. Breather pipe

The fuel is supplied through an electric pump immersed in the tank which draws in the fuel and sends it to the filter and then to the injectors.
The fuel supply system is the returnless type, i.e. there is only one connecting pipe between the fuel tank and the engine.
This system makes it possible to:

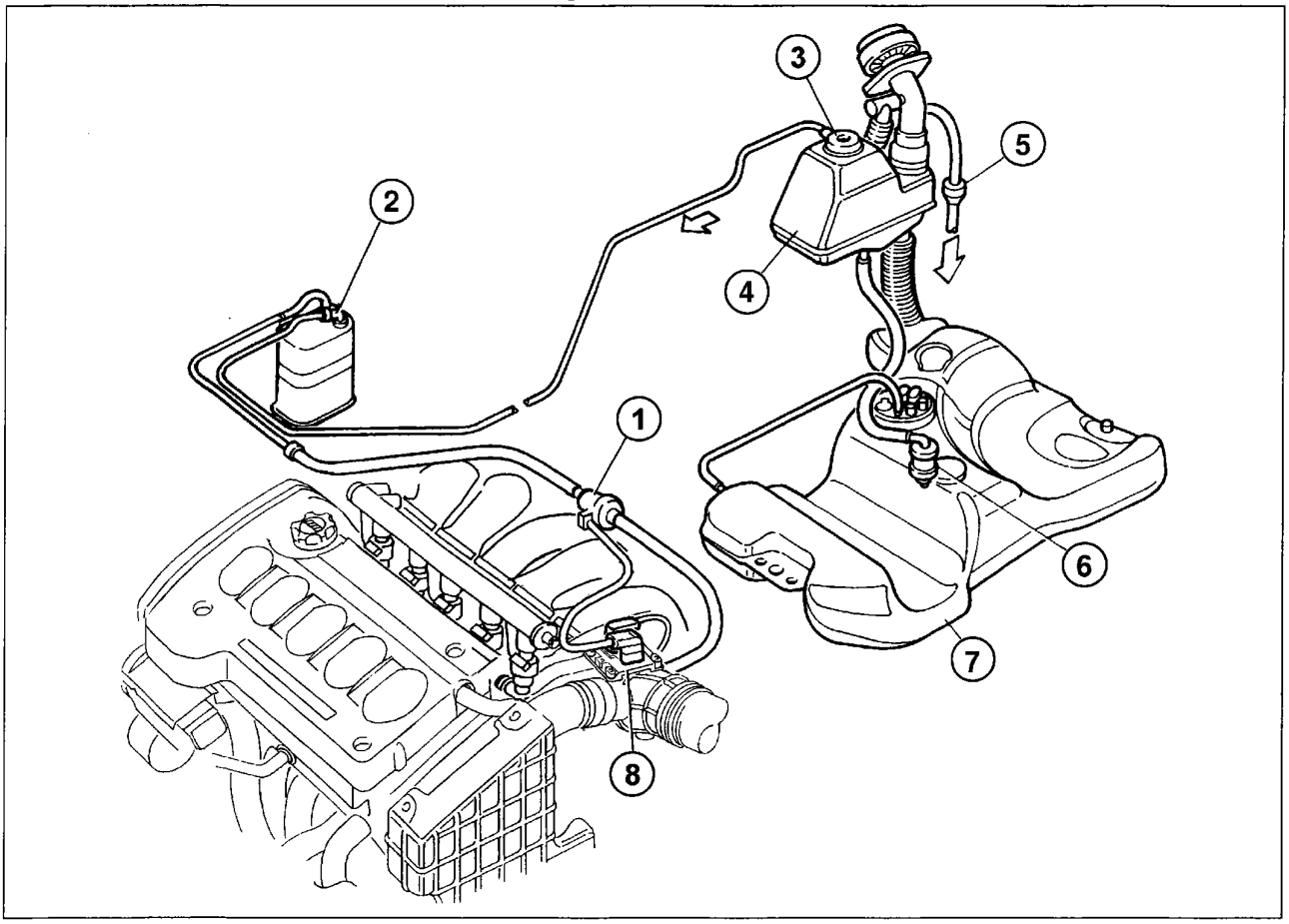
- keep the risk of the vehicle catching fire in the case of an accident to a minimum;
- reduce the fuel vapour emissions into the atmosphere.

The electric fuel pump is enclosed by the drip tray which also incorporates the fuel pressure regulator, the fuel gauge and the fuel filter.
This system is also equipped with an inertia switch which interrupts the electric fuel pump supply if the vehicle is involved in an impact.



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## FUEL ANTI-EVAPORATION CIRCUIT DIAGRAM




4A11LJ01

1. Fuel vapour cut out solenoid valve
2. Charcoal filter
3. Multi-purpose valve
4. Fuel vapour separator
5. Safety and ventilation valve
6. Float valve
7. Tank
8. Injection/ignition control unit

The anti-evaporation system is designed to prevent the fuel vapours, which are made up of the lightest fractions of hydrocarbons which form in the tank, from being discharged into the atmosphere.
The system operates above all at high outside temperatures when the temperature of the fuel increases and consequently the tendency for evaporation increases; in this situation there is an increase in pressure inside the tank (7).
In particular, even when the tank (7) is full, with the vehicle stationary the float valves (6) remain open as they are higher than the breather pipe and therefore allow the vapours to reach the separator (4), from where, on condensing, they mainly return to the tank (7).
If, on the other hand, the fuel splashes around whilst driving or the vehicle overturns, the float valves (6) close preventing the escape of fuel.
When the pressure inside the tank reaches about 30-40 mbar, the multi-purpose valve (3) opens and the fuel vapours reach the charcoal filter (2). The valve (3) also allows an intake of air into the tank through the charcoal filter, for example following the lowering of the fuel level with the consequent vacuum which is created inside the tank.
With the engine running, the control unit (8) operates the fuel vapour cut out solenoid valve (1), which allows the intake of vapours by the engine and the consequent scavenging of the charcoal filter (2).
If, as the result of the malfunction of one of the components, the pressure inside the tank increases dangerously, the safety valve (5), located near the cap, allows the pressure to be discharged outwards. If necessary, this valve can open in the opposite direction to ventilate the tank and prevent the vacuum reaching excessive levels.

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# 10.

## SYSTEM FOR RECIRCULATING GASES COMING FROM THE CYLINDER BLOCK/CRANKCASE (BLOW-BY)

This system controls the emission, from the cylinder block/crankcase, of breather gases consisting of air/petrol mixtures and burnt gases which escape from the piston seals in addition to lubricant oil vapours, recirculating them to the inlet.

The breather gases, directed by special partitions, rise by the engine oil filler and pass through the coils (7), under the tappet cover, where they lose part of the oil which they contain which returns to the camshafts, via the pipe (6), in the form of droplets.

The pipe (6) is a siphon shape to avoid the escape of breather gases
and only allow the recirculation of the oil droplets.

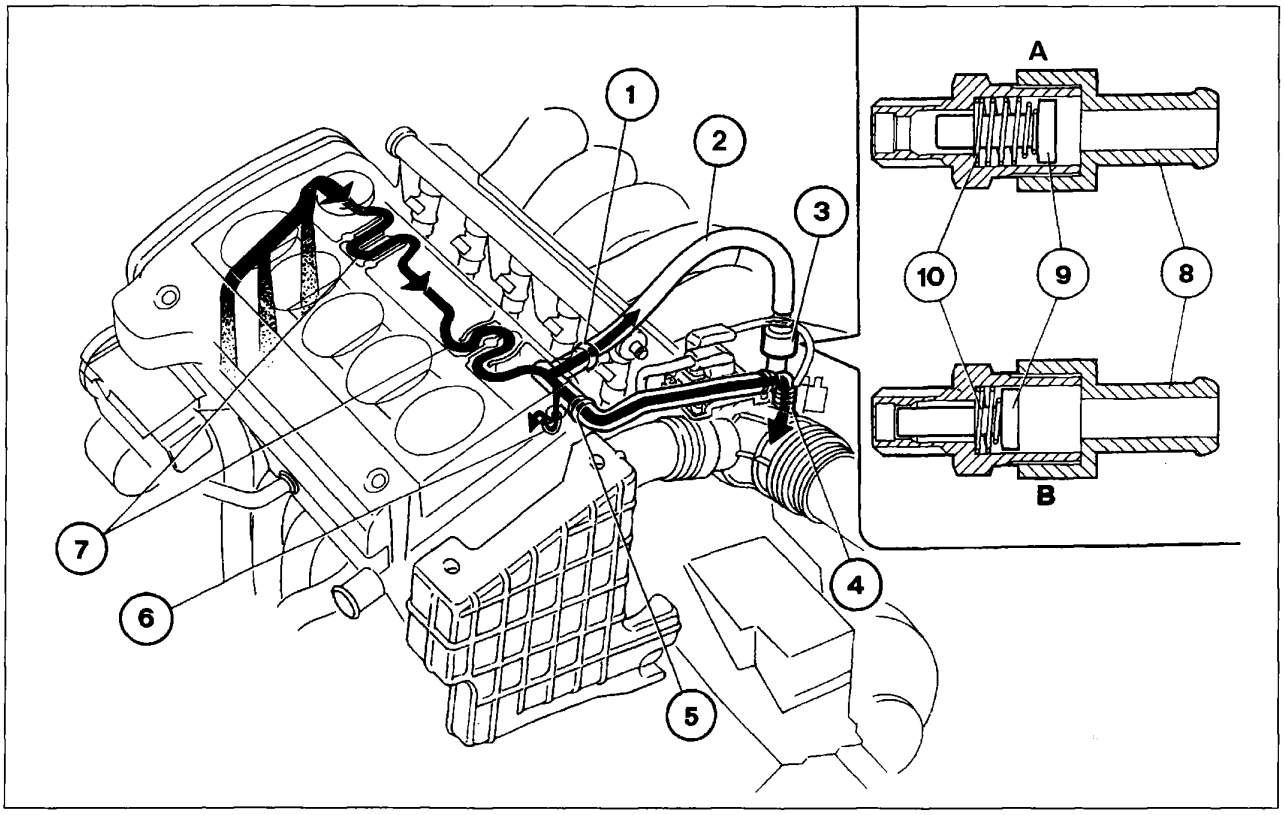
With the butterfly open, the gases escape through the outlet (5) and are sent, via the connector (4) on the air hose, upstream of the butterfly valve, to the manifold.

With the butterfly closed, the vacuum in the inlet manifold draws in the gases through the intake (1) and, via the pipe (2), they reach the connector (3) on the inlet manifold which contains a PCV valve (8) (Positive Crank Ventilation) which shutters the intake.

The PCV valve can be modulated and the quantity of gas which passes through is proportional to the vacuum in the inlet manifold.

When the butterfly valve is completely open (condition A), the vacuum inside the inlet manifold is minimal, the spring (10) is fully extendd and the PCV valve allows the maximum flow of breather gases.

Conversely, with the butterfly completed closed (condition B), the vacuum inside the manifold is maximum, which causes the movement of the piston (9) which shutters the flow of breather gaess inside the PCV valve thereby restricting the intake of gases into the manifold.

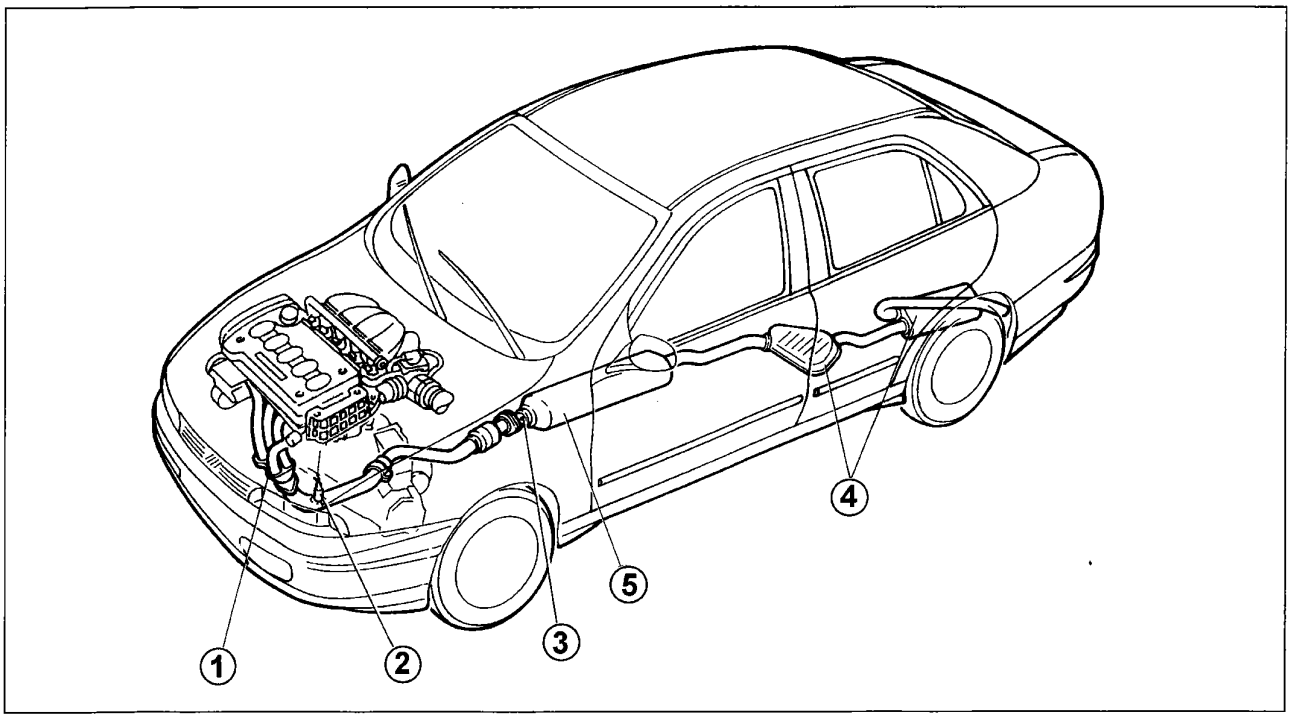



4A12JL01



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## ENGINE EXHAUST ASSEMBLY DIAGRAM




P4F13QJ01

1. Exhaust manifold
2. Lambda sensor
3. Catalytic silencer
4. Silencers
5. CO intake

The closed-loop control of the mixture strength is activated by the Lambda senor which measures the oxygen content of the exhaust gases upstream of the catalytic silencer.
The Lambda sensor measurements allow the electronic control unit to continuously correct the quantity of petrol injected keeping the air/fuel ratio constant.
This means that the harmful exhaust emissions are controlled, a task completed by the three-way catalytic converter (silencer).
The efficient operation of the catalytic silencer and the consequent restriction of the toxic exhaust gases depends on the air/fuel ratio being received by the engine.
The three-way catalytic converter makes it possible to simultaneously keep down the levels of the three pollutant gases present in the exhaust gases: unburnt hydrocarbons (HC), carbon monoxide (CO) and nitrogen oxides (NOx).
Two types of chemical reaction take place inside the converter:
- oxidation of the CO and HC, converted into carbon dioxide ($CO_2$) and water ($H_2O$);
- reduction of the NOx, converted into nitrogen ($N_2$)

The following can put the catalytic converter out of action and damage it irreparably:
- the presence of lead in the petrol which lowers the degree of conversion to such an extent that the presence of the catalytic converter in the system is rendered superfluous;
- the presence of unburnt petrol in the converter: in effect a flow of petrol lasting 30s in an ambient of 800 °C (temperature inside the silencer) is sufficient to cause the catalyzer to melt and break.

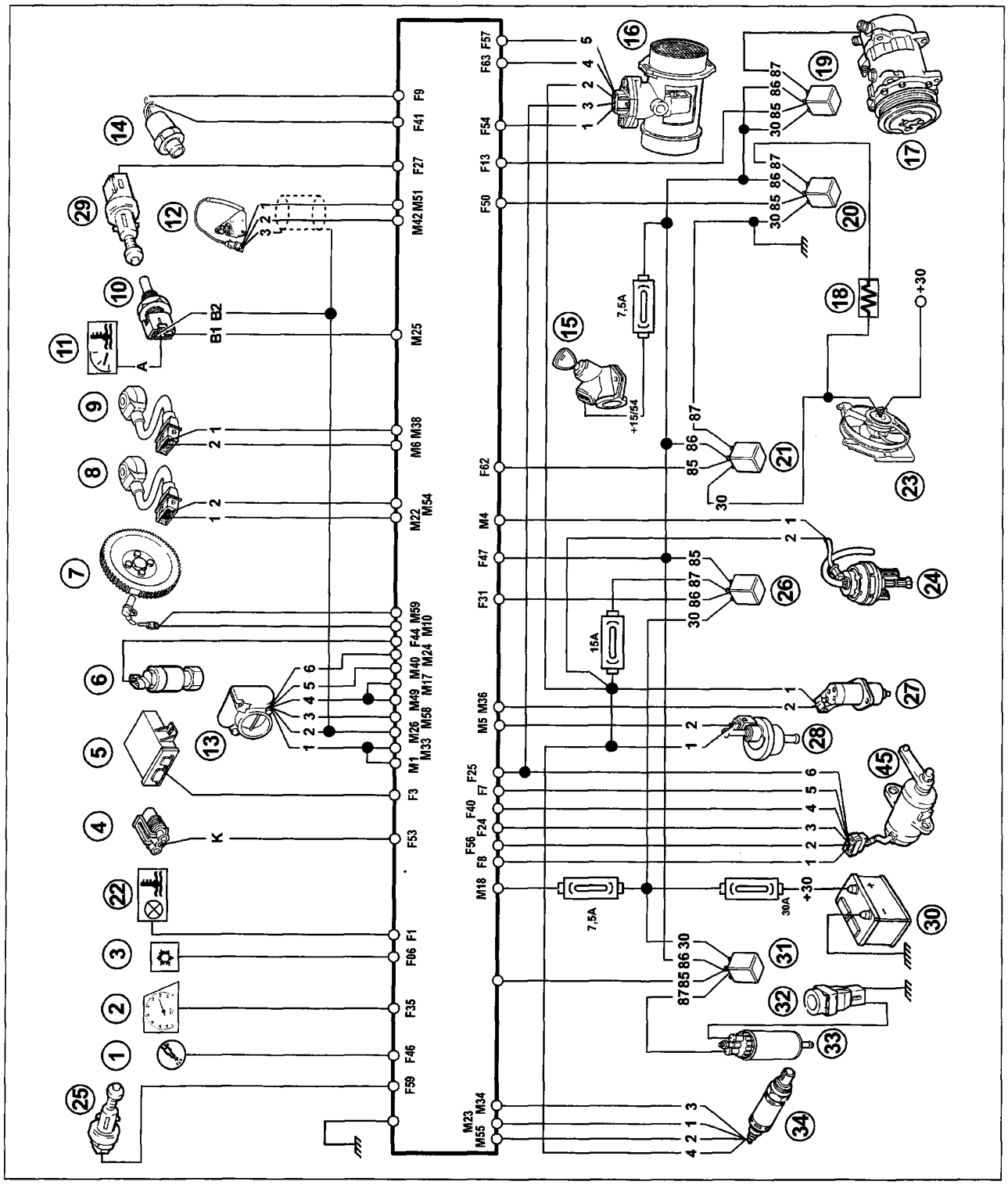
It is vital for the injection/ignition system to be working perfectly, therefore **the spark plug leads should not be disconnected, for any reason, with the engine running and the catalytic converter should be replaced with an equivalent length of pipe when carrying out tests.**



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# 10.

## INJECTION/IGNITION SYSTEM WIRING DIAGRAM

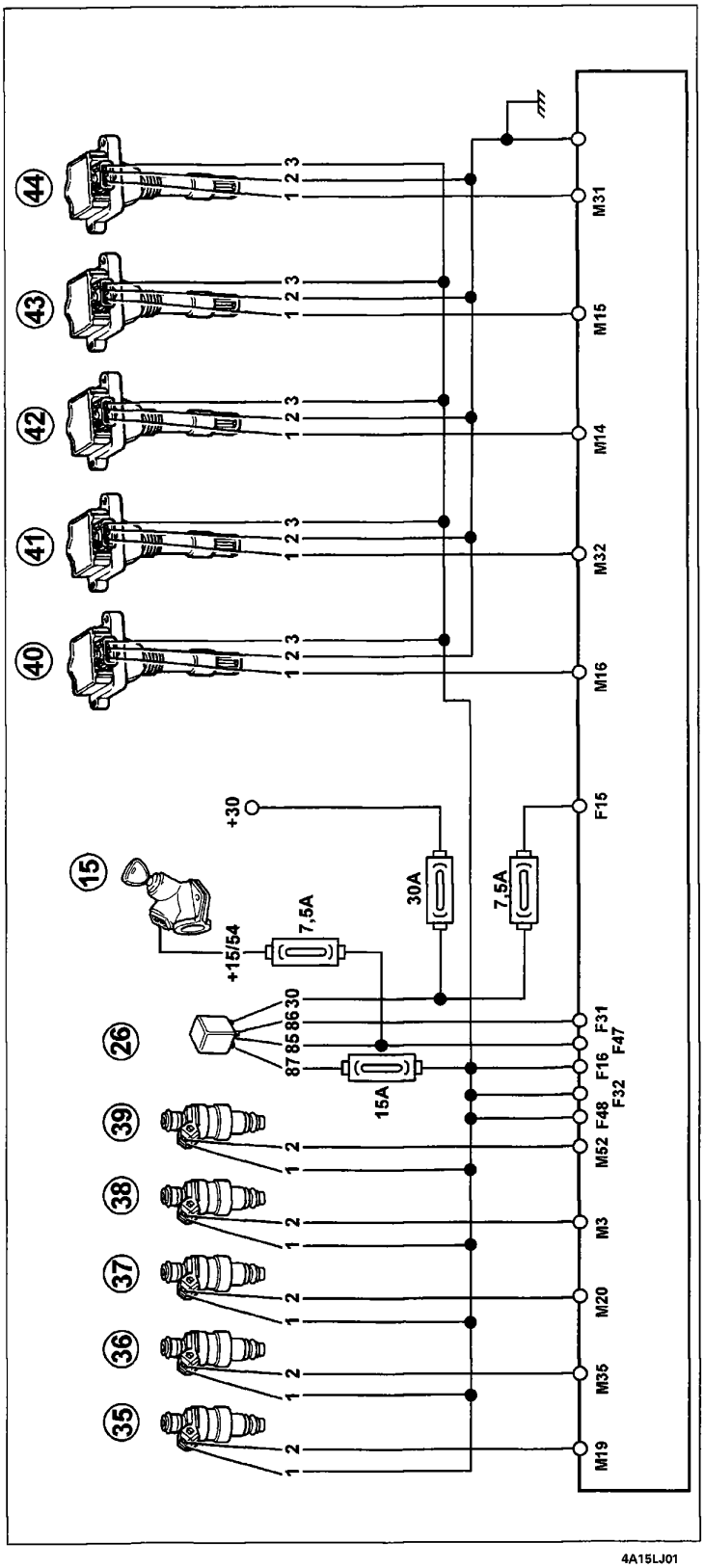



P4F14QJ01



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## Control unit/ignition coil and injector connection




4A15LJ01

**Key:**

1. Injection/ignition system failure warning light
2. Rev counter signal
3. Climate control engagement
4. Fiat CODE control unit
5. Vehicle speed senor
6. Engine rpm and TDC sensor
7. Detonation sensor 1
8. Detonation sensor 2
9. Engine coolant temperature sensor
10. Timing sensor
11. Butterfly casing actuator
12. Four stage pressure switch
13. Ignition switch
14. Flow meter
15. Air conditioning compressor
16. Flow meter
17. Air conditioning compressor
18. Radiator fan 1st speed resistance
19. Air conditioning compressor electro-magnet coupling relay
20. Radiator fan 1st speed relay
21. Radiator fan 2nd speed relay
22. Engine coolant temperature overheating warning light
23. Radiator fan
24. Variable geometry manifold fan
25. Clutch pedal switch
26. Injection/ignition system relay feed
27. Phase transformer solenoid valve
28. Fuel vapour solenoid valve
29. Brake pedal switch
30. Battery
31. Electric fuel pump and Lambda sensor relay
32. Inertia switch
33. Electric fuel pump
34. Lambda sensor

35-39. Inectors No. 1 to 5

40-44. Ignition coils for cylinders No. 1 to 5

45. Accelerator pedal potentiometer

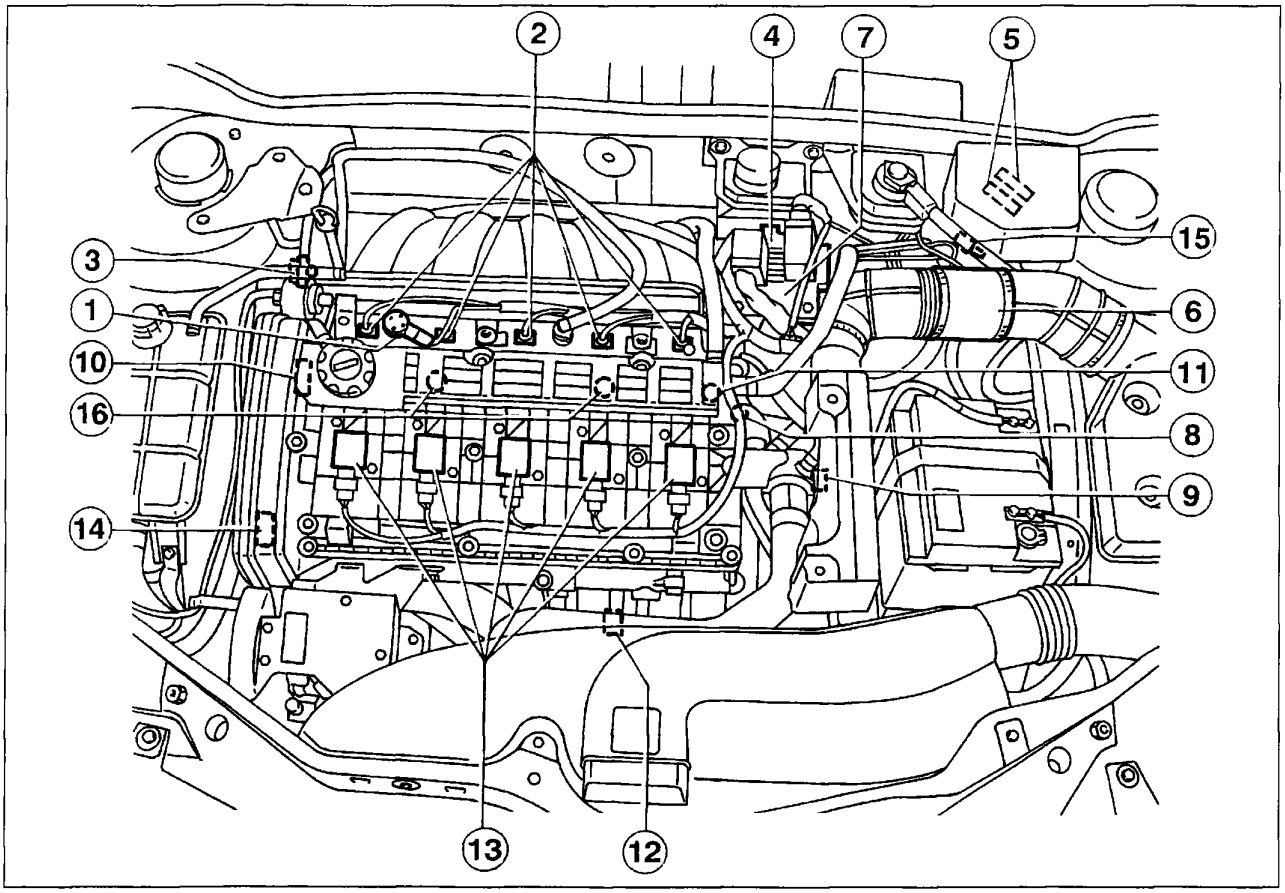
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# 10.

## LOCATION OF INJECTION/IGNITION SYSTEM COMPONENTS



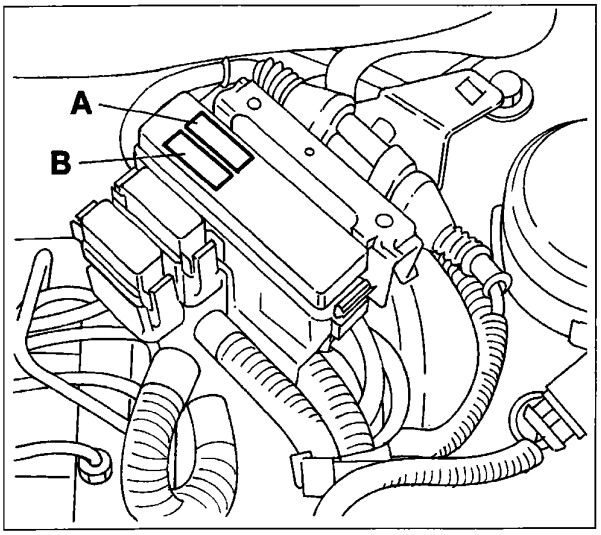

4A16LJ01

**Key**

1. Phase transformer solenoid valve
2. Injectors
3. Fuel vapour cut out solenoid valve
4. Injection/ignition control unit
5. General system protective fuse
6. Flow meter/air temperature sensor
7. Motorized butterfly casing
8. Engine coolant temperature sensor
9. Vehicle speed sensor
10. Variable geometry manifold actuator solenoid valve
11. Rpm sensor
12. Lambda sensor
13. Ignition coils
14. Timing senor
15. Diagnostic socket
16. Detonation sensors



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4A22JJ01

## FUSES AND RELAYS

**NOTE for further information, see Group 55 - Electrical equipment**

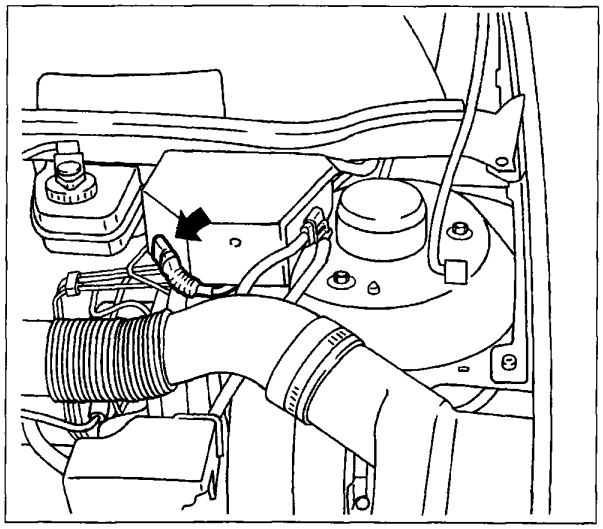
**Main fuses (maxi-fuse)**

A. system fuse
B. fuse controlled by the ignition



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# 10.



4A15JJ01

## DIAGNOSTIC SOCKET

The exchange of data between the injection/ignition control unit and the diagnostic equipment takes place via a two-way serial line (line K) using the standard Bosch communication protocol.

The positive logic transmission and the coding of the data is carried out through the NRZ methods (Non Return Zero) at a rate of 4.8 kbaud (208 µs/bit ± 5%)

### Location of diagnostic socket

The arrow in the diagram shows the location of the diagnostic socket.

## INJECTION/IGNITION SYSTEM COMPONENTS

The injection/ignition system mainly consists of wiring, an electronic control unit (I.E. control unit) and the following sensors/actuators:

### Sensors

- Speedometer sensor
- Rpm and T.D.C. sensor
- Detonation sensors
- Engine coolant temperature sensor
- Timing sensor
- Butterfly valve position sensor (integrated in the butterfly casing actuator)
- Intake air temperature sensor
- Intake air temperature and flow rate sensor (flow meter)
- Lambda sensor
- Accelerator pedal potentiometer
- Brake pedal switch
- Clutch pedal switch
-

### Actuators

- Butterfly casing actuator
- Phase transformer solenoid avlve
- Fuel vapour cut out solenoid valve
- Variable geometry manifold solenoid valve
- Electric fuel pump (including filter and pressure regulator)
- Injectors
- Ignition coils
- Spark plugs

## INJECTION/IGNITION SYSTEM WIRING

The different system components are connected by two distinct sets of wiring.
The engine side wiring (connector M) connects the components fitted on the engine to the injection control unit; the vehicle side wiring (connector F) connects the other components to the control unit and constitutes the interface with the other vehicle wiring.
The two connectors (M and F) are the same and both have 64 pins, but it is not possible to mix up the control unit connector wiring.

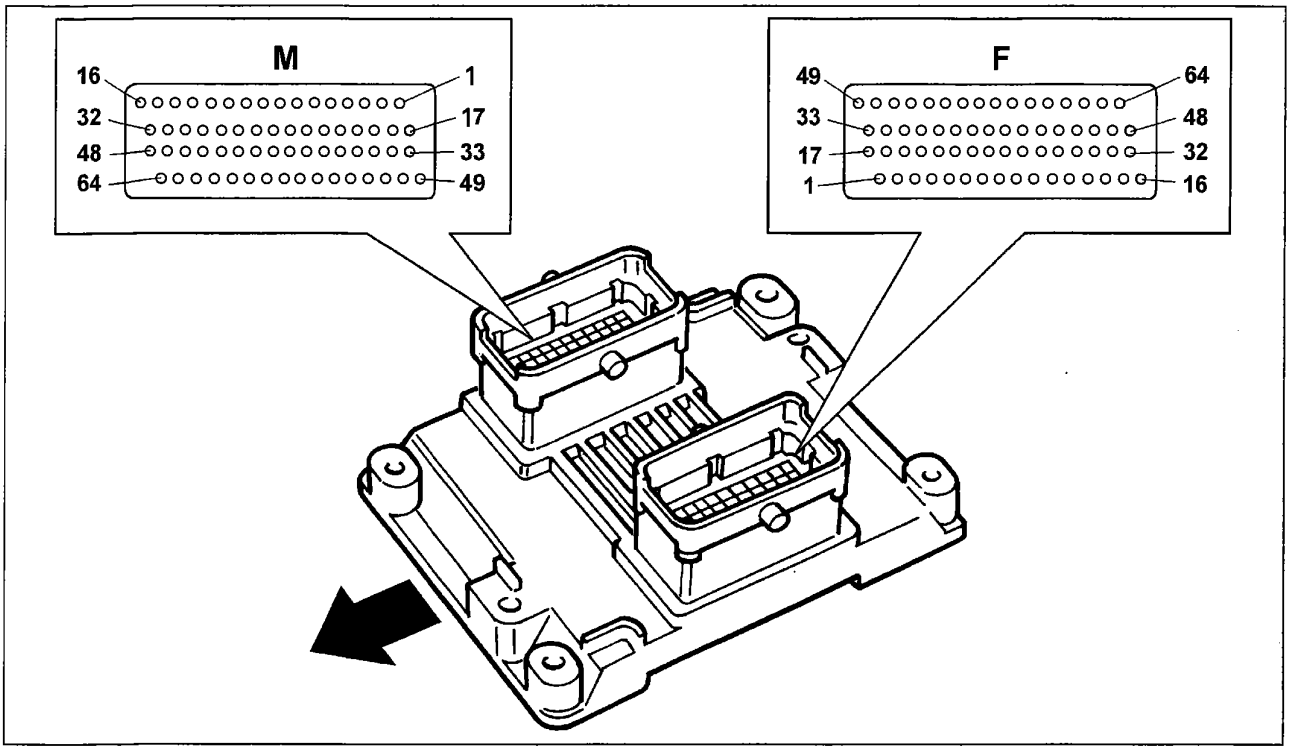
## INJECTION/IGNITION ELECTRONIC CONTROL UNIT

The injection/ignition electronic control unit is located in the engine compartment, fixed to a bracket at the side of the inlet manifold.
The control unit processes the signals coming from the various sensors through the application of software algorhythms and operates the actuators (in particular, the injectors and the pressure regulator) in order to ensure the best possible operation of the engine.
The control unit is the flash E.P.R.O.M. type, i.e. it can be reprogrammed from the outside without having to adjust the hardware.



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Identification of control unit connections (Pin out)




4A19LJ01

**Connector F**

1. Engine coolant overheating warning light
2. Not connected
3. Fiat CODE control unit
4. Not connected
5. Not connected
6. Reqeust to engage climate control system compressor
7. Accelerator pedal potentiometer 1 supply
8. Accelerator pedal potentiometer 1 signal
9. Request to engage radiator fan low speed
10. Not connected
11. Not connected
12. Not connected
13. Climate control system compressor engagement
14. Not connected
15. Supply from battery
16. Supply from relay
17. Not connected
18. Not connected
19. Not connected
20. Not connected
21. Not connected
22. Not connected
23. Not connected

**Connector M**

1. Butterfly casing motor (-)
2. Not connected
3. Injector for cylinder 4
4. Variable geometry manifold actuator
5. Fuel vapour cut out solenoid valve
6. Detonation sensor 2 reference earth
7. Not connected
8. Not connected
9. Not connected
10. Not connected
11. Not connected
12. Not connected
13. Not connected
14. Ignition coil for cylinder 3
15. Ignition coil for cylinder 4
16. Ignition coil for cylinder 1
17. Butterfly casing motor (+)
18. Not connected
19. Injector for cylinder 1
20. Injector for cylinder 3
21. Not connected
22. Detonation sensor 1 signal
23. Lambda sensor signal

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# 10.

Connector F

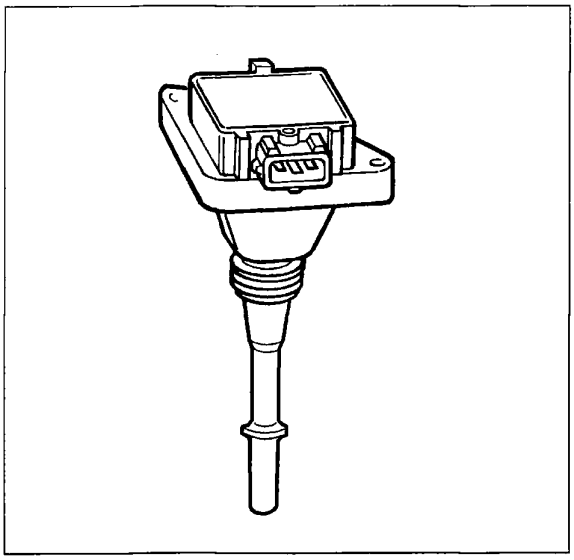
24. Accelerator pedal potentiometer 1 earth
25. Accelerator pedal potentiometer 2 earth and air flow meter
26. Not connected
27. Brake pedal switch
28. Not connected
29. Not connected
30. Electric fuel pump relay
31. Fuel system relay go ahead
32. Supply from relay
33. Not connected
34. Not connected
35. Rev counter signal
36. Not connected
37. Not connected
38. Not connected
39. Not connected
40. Accelerator pedal 2 potentiometer signal
41. Radiator fan high speed engagement request
42. Not connected
43. Not connected
44. Vehicle speed signal
45. Not connected
46. Injection system failure
47. Supply from ignition switch
48. Supply from relay
49. Not connected
50. Radiator fan low speed engagement go ahead
51. Not connected
52. Not connected
53. Diagnostic socket, line K
54. Intake air temperature signal
55. Not connected
56. Accelerator pedal 2 potentiometer supply
57. Intake air quantity signal
58. Not connected
59. Clutch pedal switch
60. Not connected
61. Not connected
62. Radiator fan high speed engagement go ahead
63. Flow meter reference voltage
64. Not connected

Connector M

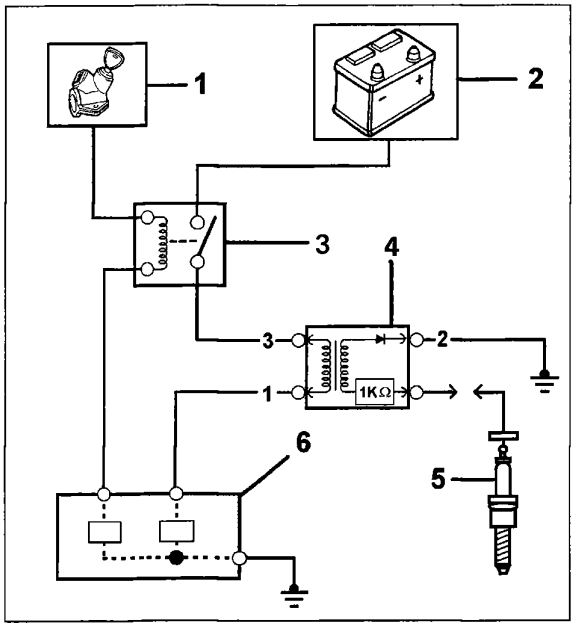
24. Butterfly casing potentiometer 1 signal
25. Engine coolant temperature
26. Temperature sensor, butterfly casing potentiometers 1 and 2 reference earth
27. Not connected
28. Not connected
29. Not connected
30. Not connected
31. Ignition coil for cylinder 5
32. Ignition coil for cylinder 2
33. Butterfly casing motor (-)
34. Lambda sensor heater earth
35. Injector for cylinder 2
36. Phase transformer solenoid valve
37. Not connected
38. Detonation sensor 2 signal
39. Not connected
40. Butterfly casing potentiometer 2 signal
41. Not connected
42. Timing sensor signal
43. Not connected
44. Not connected
45. Not connected
46. Not connected
47. Not connected
48. Not connected
49. Butterfly casing motor (+)
50. Not connected
51. Timing sensor reference voltage
52. Injector for cylinder 5
53. Not connected
54. Detonation sensor 1 reference earth
55. Lambda sensor reference earth
56. Not connected
57. Not connected
58. Buttefly casing potentiometer 1 and 2 supply
59. Engine rpm sensor
60. Not connected
61. Not connected
62. Not connected
63. Not connected
64. Not connected



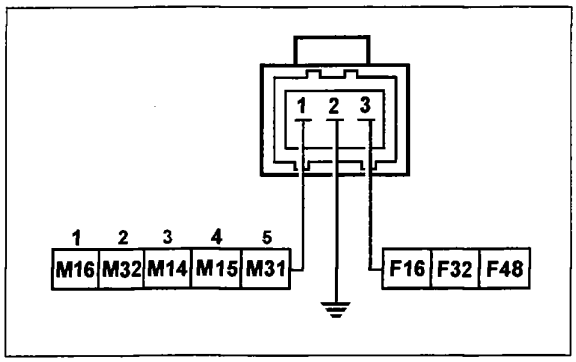
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4A21LJ01




4A21LJ02




4A21LJ03

## IGNITION COILENS (0.221.504.014)

The ignition is the static advance electronic type with one single coil for each cylinder; this solution eliminates the high tension circuit, increasing reliability and safety and decreasing the risk of interference due to high tension leads and connectors.
It involves an ordinary coil which increases the voltage of the impulse sent to the spark plugs; each individual coil, located on the cylinder head, directly supplies a spark plug without intermediate leads.

### Checking coil primary circuit resistance

The resistance is checked by connecting an ohmmeter to the connector outside pins (pins 1 and 3):

**Primary resistance: 0.73 ohm**

### Electrical specifications

Primary winding inductace.....**2.5** mH
Primary winding resistance.....**0.73** Ω
Anti-interference resistance.....1 KΩ

### Electrical connections wiring diagram

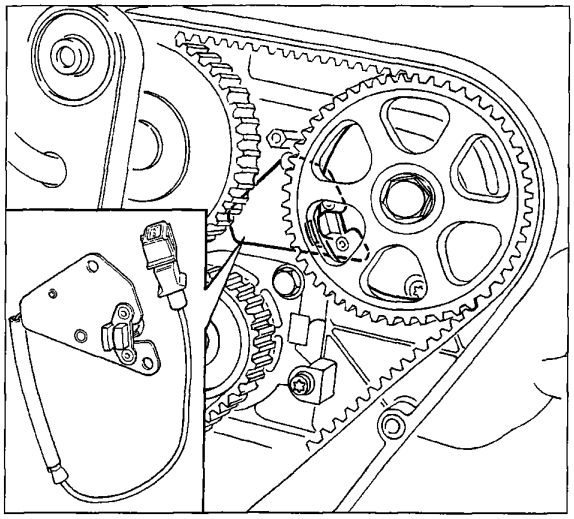
A. Operating signal
X. Primary winding
1. Ignition switch winding
2. Single coil
3. Electronic spark plug
4. Spark plug

### Connector wiring

The numbers connector to pin 1 indicate the corresponding pins for the control unit arranged in the order of the cylinder numbers.



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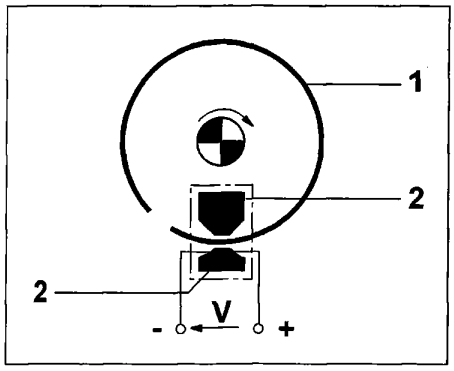


4A22LJ01

## TIMING SENSOR (0.232.101.026)

The injection system in the Bosch Motronic ME 3.1 system is the phased, sequential type, i.e. the injection of the fuel takes place in sequence for each cylinder during the inlet stroke.
To achieve this, in addition to the rpm and TDC signal, the electronic control unit also uses a timing signal to determine the point of injection.
The signal sent to the control unit is produced by a Hall effect sensor fitted by the exhaut side camshaft drive pulley.

### Operating principle




4A22LJ02

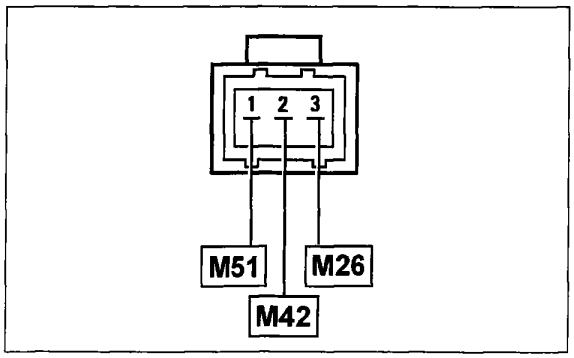
1. Deflector (pulley seal)
2. Magnetic material

A semi-conductor layer through which a current passes, immersed in a normal magnetic field (lines of force perpendicular to the direction of the current), produces a difference in power at its terminals known as HALL voltage.
If the intensity of the current remains constant, then the voltage produced only depends on the intensity of the magnetic field; the intensity of the magnetic field simply has to be periodically altered to produce a modulated electrical signal whose frequency is proportional to the speed at which the magnetic field changes.
To produce this change, a metal ring (inner part of the pulley) with an opening is passed through the sensor. As it moves, the metal part of the ring covers the sensor, stopping the magnetic field with a consequent low output signal; conversely, for the opening, where the magnetic field is present, the sensor produces a high signal.

As a result, a high signal alternates with a low signal once for every two revolutions of the engine, namely when cylinder N°1 is 78° before TDC. This signal, together with the rpm and TDC signal, allows the control unit to recognize the cylinders and determine the point of injection. For each engine revolution the control unit checks that there is a timing signal; if this signal is missing for two consecutive revolutions, the control unit signals the fault (warning light in the dashboard comes on) and does not allow the engine to be started up.

### Connector wiring

The numbers indicate the corresponding control unit pins




4A22LJ03

### Removing-refitting

This operation involves the removal of the toothed belt from the timing system and from the exhaust side camshaft toothed pulley.

Having carried out these operations, it is necessary to:

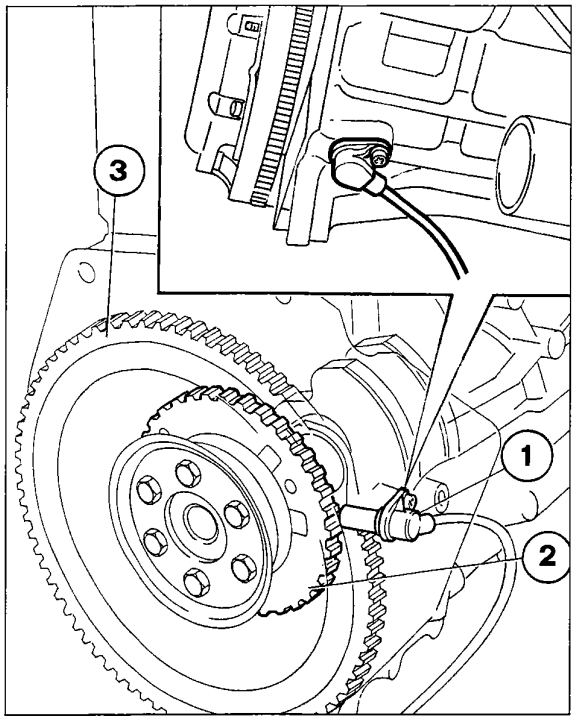
- disconnect the electrical connector;
- undo the fixing bolts and remove the sensor.

When refitting, reverse the order of the operations carried out for the removal, following the instructions for refitting and tensioning the toothed belt.

**NOTE** *The sensor does not require any type of adjustment*

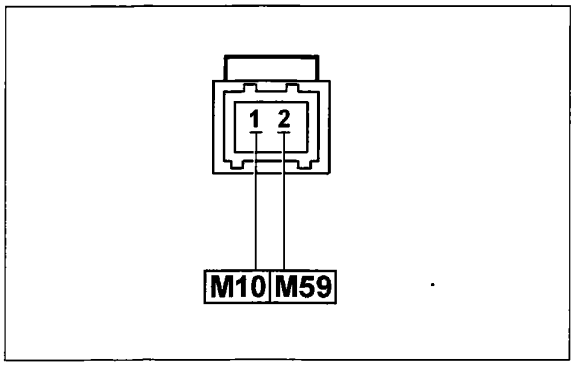


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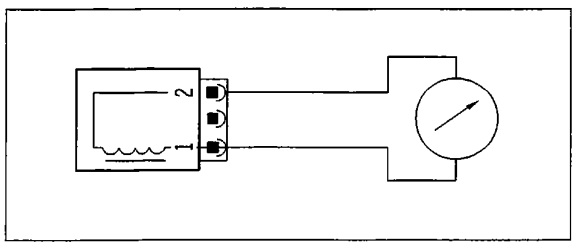



4A23LJ01

1. Rpm sensor
2. Toothed pulley
3. Engine flywheel




4A23LJ02




4A23LJ03

## ENGINE RPM AND TDC SENSOR (0.261.210.160)

This sensor which measures the engine speed and TDC is the inductive type, i.e. it operates through the variation in the magnetic field produced by the passing of the teeth on a toothed pulley (flywheel) located inside the cylinder block/crankcase and fixed to the crankshaft rear counter-weight. In this way the sensor is fixed to the cylinder block/crankcase and the gap and the angular position no longer need to be checked or adjusted.

The teeth which pass in front of the sensor alter the gap between the pulley and the sensor; the dispersed flow, which varies as a result, produces an alternating voltage whose frequency depends on the number of revs.

The flywheel has 58 teeth plus a space equivalent to the missing two teeth.

The reference defined by the space for the missing two teeth constitutes the basis for detecting the point of synchronism (TDC).

### Removing-refitting

Position the vehicle on a lift then, working from the underneath of the vehicle:

- disconnect the electrical connection;
- undo the bolt fixing the senor and remove it from its housing.

### Connector wiring

The sensor is connected to the electronic control unit (pins M10 and M59) by means of twisted cables covered by an outer casing.

The numbers indicate the corresponding control unit pins.

### Checking the resistance

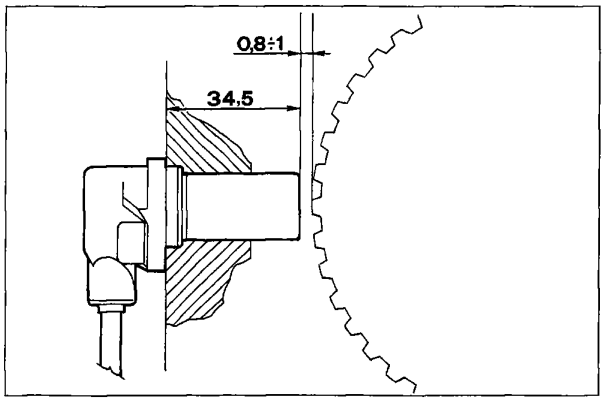
The sensor resistance can be measured by disconnecting the connector and connecting an ohmmeter to the sensor terminals.

**Resistance: 774-946 ohm at 20°C**



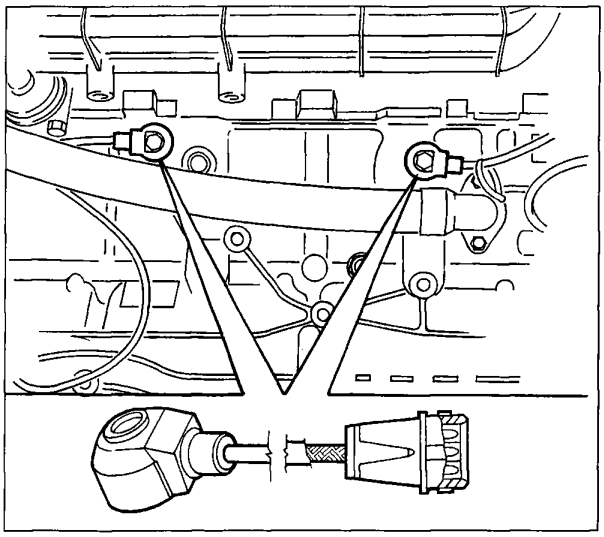
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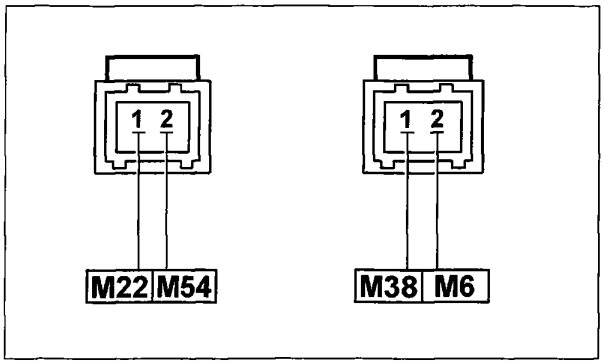



4A24LJ01

*When measuring the distance it is imperative to be at right angles with the flywheel and corresponding to a tooth and not a gap.*



4A24LJ02




4A24LJ03

## Checking the gap

The rpm and TDC sensor is fixed directly to the cylinder block/crankcase and therefore the gap and the angular position no longer need to be adjusted. If a fault is suspected it is, however, possible to check the gap, proceeding as follows:

- remove the rpm and TDC sensor;
- check that the distance between the surface of the sensor and the flywheel tooth corresponds to the sum of the length of the sensor (34.5 mm) and the gap (0.8 - 1.5 mm).

## DETONATION SENSORS (0.261.231.131)

The detonation sensors are located on the monobloc under the inlet manifolds and between cylinders 1-2 and 4-5.

These sensors have a bush to prevent incorrect torque tightening.

**In the case of replacement, do not place washers or shims between the cylinder block/crankcase and sensor contact surfaces.**

When the engine is knocking (detonation), vibrations of a certain frequency are produced in the cylinder block/crankcase.
This phenomenon produces a mechanical repercussion on a piezoelectric crystal which sends a signal to the control unit; on the basis of this signal the control unit reduces the ignition advance (from 3° up to a maximum of 9.7°) until the phenomenon disappears. Later on, the advance is gradually restored to the basic value.

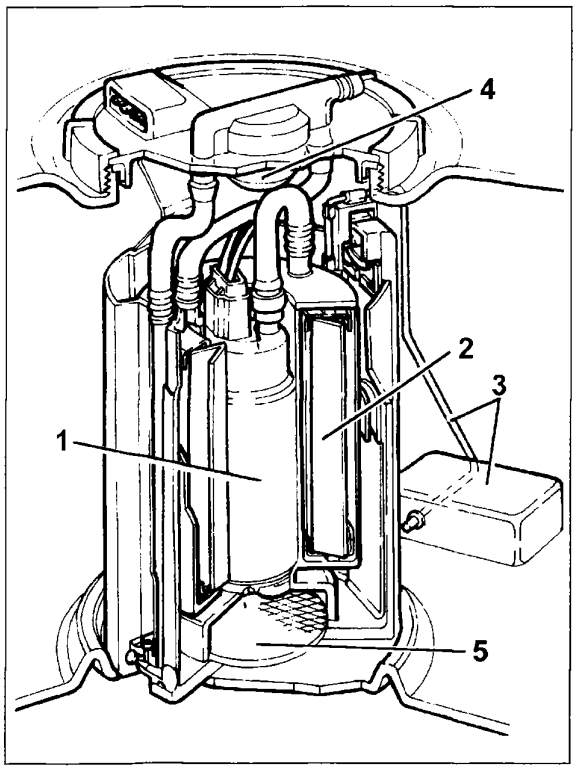
## Connector wiring

The sensors are connected to the electronic control unit (Pins M22/M54 and M38/M6) by means of twisted cables with a protective outer casing.

The numbers indicate the corresponding control unit pins.



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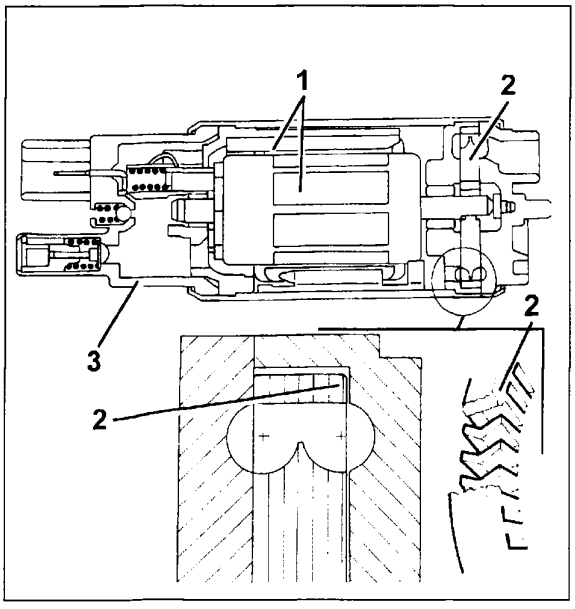

4A25LJ01

## ELECTRIC FUEL PUMP (0.580.313.011)

The electric fuel pump is located inside the fuel tank, housed in a drip tray which also incorporates:

- the fuel pressure regulator;
- the fuel gauge;
- the fuel filter.

1. Electric fuel pump;
2. Fuel filter;
3. Fuel gauge with float;
4. Pressure regulator with diaphgram;
5. Gauze pre-filter;




4A25LJ02

The electric fuel pump has an electric motor with a permanent magnet (1) which operates the pump (2) impeller and a support cover (3) which contains the electrical and hydraulic connections.

The electric pump stage is the peripheral flow single type with high performance in low voltage and temperature conditions.

The advantages compared with electric pumps which operate on the volumetric principle are:

- lighter;
- smaller

## FUEL SUPPLY MANIFOLD

The fuel manifold is fixed to the inner part of the inlet manifold and its function is to send fuel to the injectors. The fuel manifold is made from die-cast aluminium and incorporates the injector seats. The fuel intake is achieved through a tapered fixing bolt.

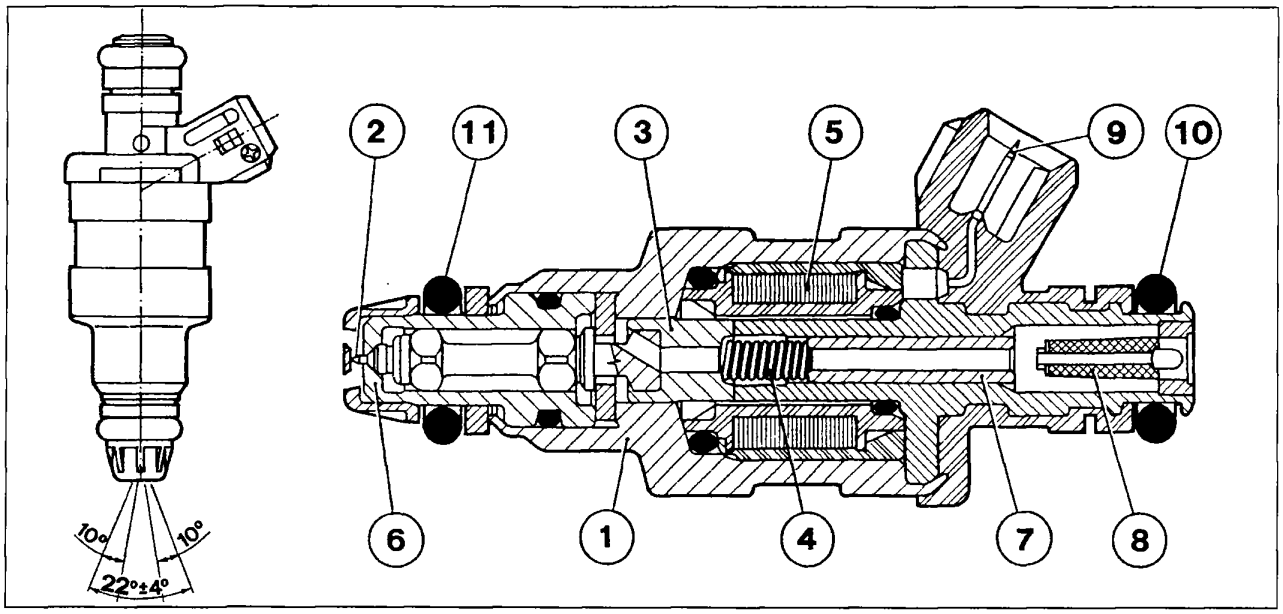


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# 10.

## INJECTORS (0.280.155.770)

The twin jet type injectors are fitted on the inlet manifolds, immediately before the inlet valves.
These injectors are specific to engines with 4 valves per cylinder, in effect making it possible to direct the jets towards the two inlet valves.
The jets of fuel which come out of the injector at a pressure of 3 bar are instantly atomized forming two cones of about 10° each.
The operation of the injectors is the "phased, sequential" type, i.e. the five injectors are operated according to the inlet sequence of the engine cylinders, whilst the supply can already start for any cylinder during the expansion stroke until the inlet stroke has already commenced.
The injectors are fixed by the fuel manifold, which presses them into the seats in the inlet manifold. They are also secured to the fuel manifold by means of "safety clips". Two rubber seals (10) and (11) ensure the seal on the inlet manifold and the fuel manifold.

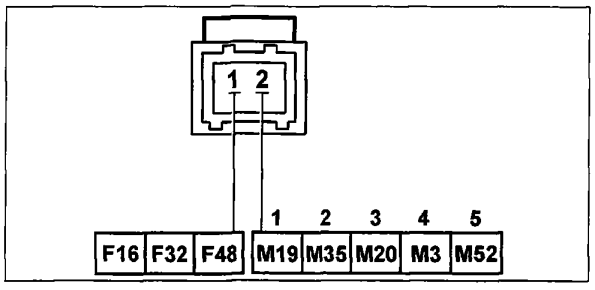



4A26LJ01

1. Injector body
2. Needle
3. Magnetic core
4. Coil spring
5. Winding
6. Injector nose
7. Adjustable spring
8. Fuel filter
9. Electrical connection socket
10. Fuel seal
11. Vacuum seal

### Connector wiring

The numbers indicate the corresponding control unit pins arranged in the order of the cylinder numbers.

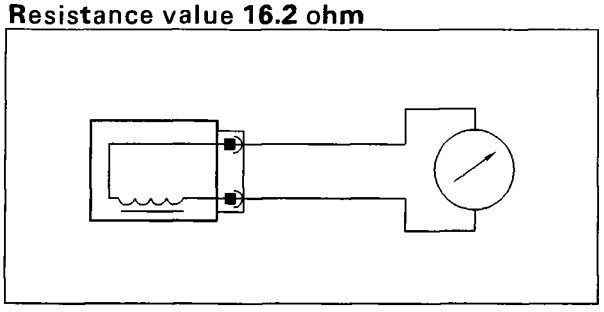



4A26LJ02

### Checking the resistance

The injector resistance can be measured by disconnecting the connector and connecting an ohmmeter as illustrated in the diagram.

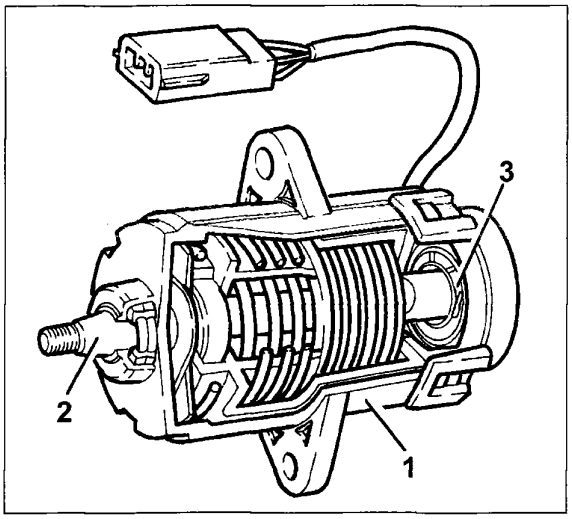
**Resistance value 16.2 ohm**



4A26LJ03



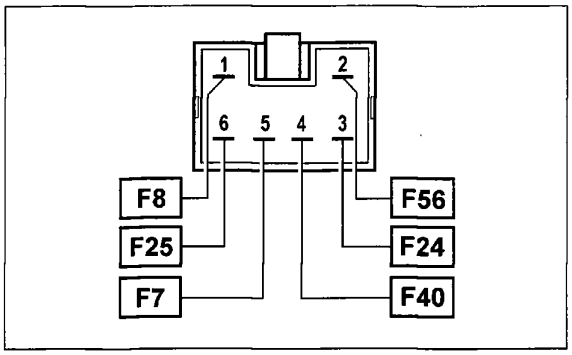
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4A27LJ01

## ACCELERATOR PEDAL POTENTIOMETER (0.281.002.203)

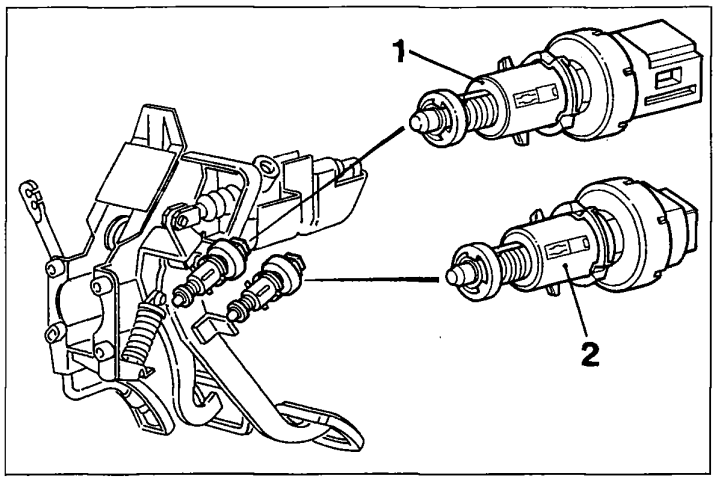
The position of the accelerator pedal is transformed into an electrical voltage signal and sent to the injection control unit by the potentiometer connected to the pedal.
The accelerator pedal position signal is processed, together with the information relating to the number of revs, to obtain the injection times and pressure.
The sensor consists of a casing (1), fixed to the pedals assembly by means of a flange, which contains a shaft (2), in an axial position, connected to the two potentiometers (3): one main one and one safety one.
One coil spring on the shaft guarantees the correct resistance to pressure, whilst a second spring ensures the return on release.




4A27LJ02

### Connector wiring

The numbers indicte the corresponding control unit pins.




4A27LJ03

## BRAKE PEDAL SWITCH

There is a switch (1) on the brake pedal which operates the brake lights; the same switch also sends a signal to pin F27 of the injection control unit.

the "brake pedal pressed" signal is used by the control unit to:

- understand that there is a deceleration situation;
- check the plausibility of the signal coming from the accelerator potentiometer.

## CLUTCH PEDAL SWITCH

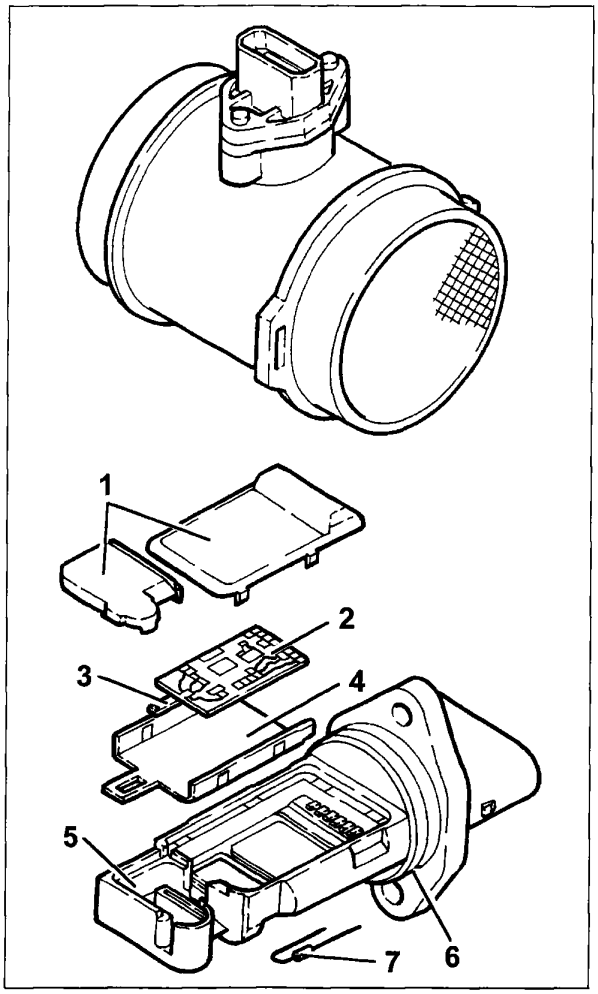
There is a switch (2) on the clutch pedal connected to pin F59 of the injection control unit.

The "clutch pedal operated" signal is used by the injection control unit to distinguish the gear engaged and gear change conditions.

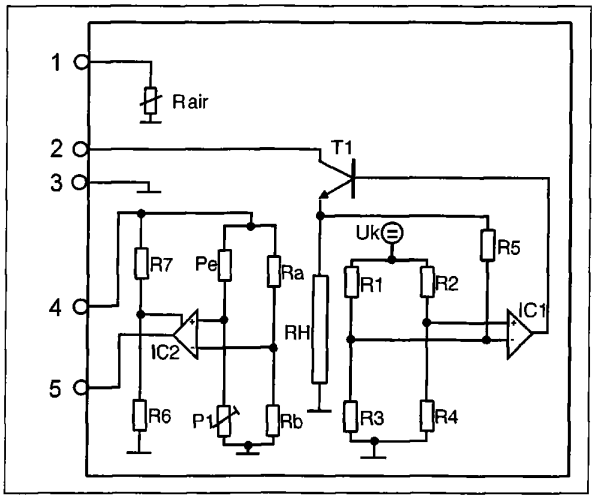


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# 10.




4A28LJ01




4A28LJ02

1. Air temperature signal
2. Battery voltage
3. Earth
4. Reference voltage (5V)
5. Air flow rate signal

## AIR FLOW METER (0.281.002.199)

The flow meter is located on the air inlet hose and is the "heated film" type.
The intake air temperature sensor is inside the flow meter.
The operation is based on a heated diaphragm located in a measuring duct through which the intake air entering the engine flows.
The hot film diaphragm is kept at a constant temperature (about 120 °C higher than the temperature of the entering air) by the heating resistance.
The mass of air which passes through the measuring duct tends to remove heat from the diaphragm therefore, in order to keep the latter at a constant temperature, a certain current must flow through the resistance.
This current, being proportional to the mass of air flowing to the engine, is measured by a Wheatstone bridge and the signal is sent to the injection control unit.

1. Covers
2. Electronic card
3. Sensor
4. Support plate
5. Support
6. Seal (O-Ring)
7. Temperature sensor

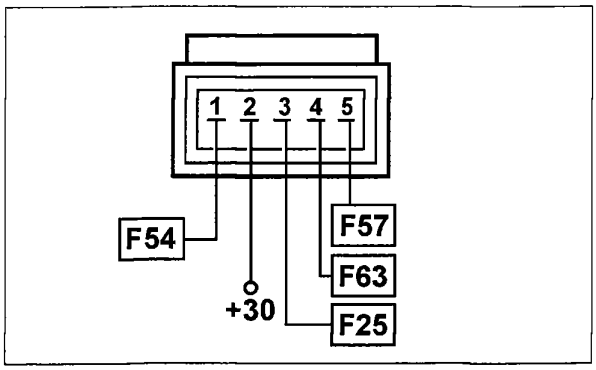
**NOTE** *This flow meter measures the mass of air (and not the volume) directly, thereby eliminating problems of temperature, altitude, pressure, etc.*

### Description of the operation

The Wheatstone bridge (made up of resistors R1,R2,R3,R4) is balanced when R3 is about 120 °C higher than the temperature of the air.
The air passing through the diaphragm removes heat from R3, therefore the bridge is unbalanced.
This situation is detected by the circuit at IC1 which operates transistor T1, in a manner which is proportional to the imbalance of the bridge, and as a result more current is directed through Rh to heat up R3 and restore the equilibrium of the bridge.
The circuit IC2 measures the current passing through Rh.
This current makes it possible to keep the bridge balanced and is consequently proportional to the mass of air passing through the air flow meter.



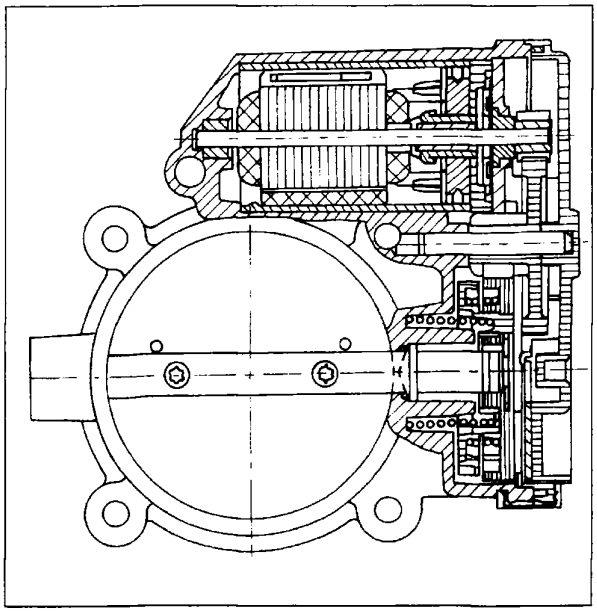
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4A29LJ01

Connector wiring

The numbers indicate the corresponding control unit pins.

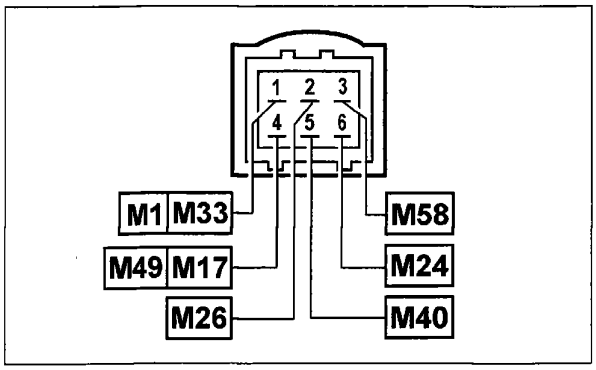


4A29LJ02

## BUTTERFLY CASING ACTUATOR

The actuator is fixed to the inlet chamber and regulates the quantity of air drawn in by the engine.
According to the signal coming from the accelerator pedal potentiometer, the injection control unit controls the opening of the butterfly by means of a direct current motor incorporated in the butterfly casing actuator.
The butterfly casing actuator has two potentiometers, connected in parallel so that one controls the other and viceversa.
If the two potentiometers fail or if there is no supply, the control unit reduces the engine torque depending on the position of the accelerator pedal.
The replacement of the butterfly casing actuator or the injection control unit requires the "self-learning" procedure described below to be carried out.

- Place the ignition key in the ON position and keep it there for 30 sees.
- Turn the ignition key to the OFF position for 5 sees.
- Turn the key to the ON position and start up the engine.




4A29LJ03

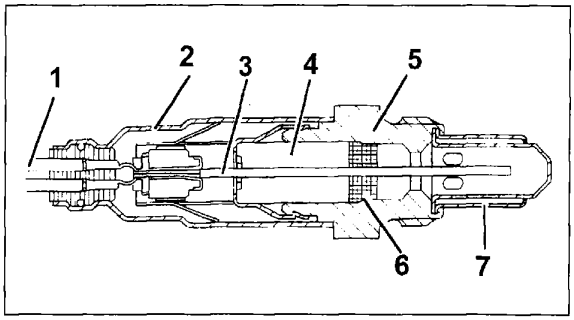
Connector wiring

The numbers indicate the corresponding control unit pins.



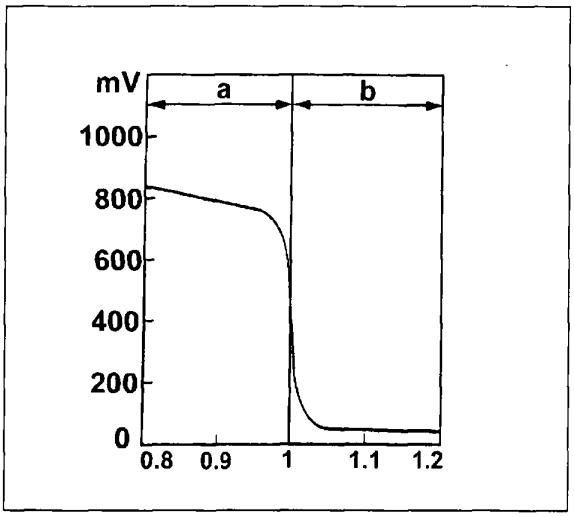
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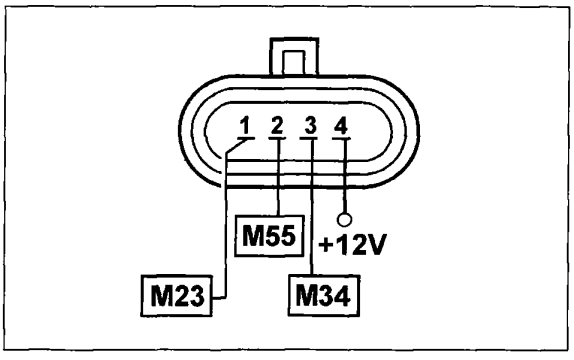

4A30LJ01

1. Connecting cable
2. Protective sleeve
3. Planar sensor element
4. Ceramic support pipe
5. Sensor housing
6. Ceramic seal
7. Protective tube




4A30LJ02

a. Rich mixture (lack of air)
b. Lean mixture (excess air)




4A30LJ03

## LAMBDA SENSOR (B.258.040.092)

The Lambda sensor is the "planar" type, fitted on the front section of the exhaust pipe and informs the injection control unit of the progress of the combustion (stoichiometric ratio).
To obtain an ideal mixture the quantity of air drawn in by the engine must be equal to the theoretical amount required to burn all the fuel injected.
In this case the Lambda factor (λ) i.e. the ratio between the quantity of intake air and the theoretical quantity of air (which is required to burn all the fuel injected) is equal to 1.
Therefore:

$\lambda = 1$ ideal mixture

$\lambda > 1$ lean mixture

$\lambda < 1$ rich mixture

The Lambda sensor, in contact with the exhaust gases, produces an electrical signal, whose voltage value depends on the concentration of oxygen in the actual gases.
This voltage undergoes a sharp variation when the composition of the mixture shifts from the value $\lambda = 1$.
The heating of the Lambda sensor is managed by the injection control unit proportionally to the temperature of the exhaust gases.
This prevents thermal shocks to the ceramic casing due to contact with the condensed water present in the exhaust gases when the engine is cold.
The measuring cell and the heater are incorporated in the "planar" stratified ceramic element with the advantage of the rapid heating of the cell to allow the closed loop control (=1) within several seconds of the engine being started up.

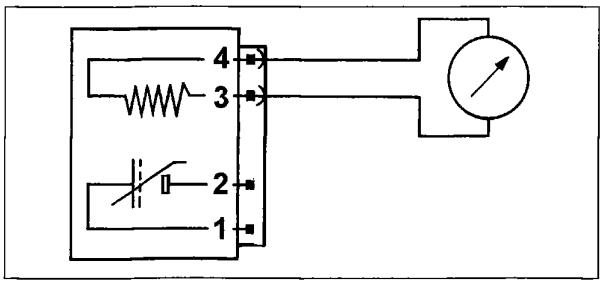
### Connector wiring

The numbers indict the corresponding control unit pins.



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*The sensor can be rapidly put out of action by the presence of even slight amounts of lead in the fuel.*

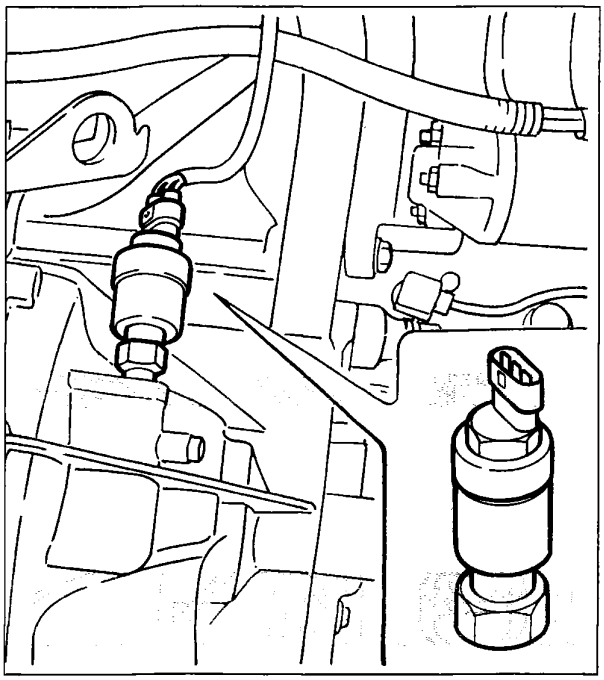



4A31LJ01

### Checking the resistance

The resistance of the heater and the senor can be measured by disconnecting the connector and connecting an ohmmeter as illustrated in the diagram.

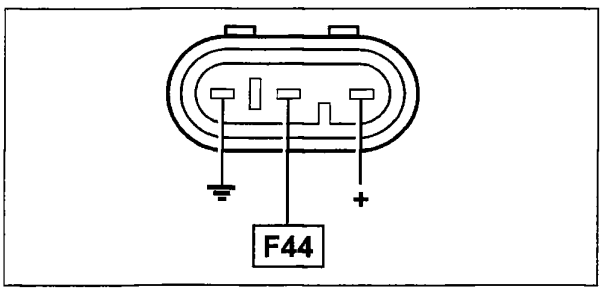
Resistance = **500-1000** ohm at **20°C**



4A31LJ02

## SPEEDOMETER SENSOR

The speedometer sensor (vehicle speed sensor) is located at the differential output, by the left driveshaft coupling and trasmits information concerning the vehicle speed to the control unit: the signal is also used for the operation of the speedometer.
The sensor is the Hall effect type (see "engine timing sensor" paragraph) and is calibrated so that a distance of one metre corresponds to each impulse; it is therefore possible to determine the speed of the vehicle from the frequency of the impulses.
The control unit uses this information to improve the management of the engine idle adjustment actuator and for the CUT-OFF strategy.




4A31LJ03

### Connector wiring

The numbers indicate the corresponding control unit pins.



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# 10.

## PHASE TRANSFORMER

In order to ensure a good compromise between high performance in terms of power at high speeds and good torque at low speeds, this engine is fitted with an (electronically controlled, hydraulically operated) phase transformer for the inlet camshaft.

This device makes it possible to alter the timing diagram (inlet stroke) according to the engine load requirements; this parameter is processed by the MOTRONIC control unit according to the electrical signals received from the air flow meter and the rpm sensor and is sent as a command to the phase transformer electro-magnet.

The construction of the device consists of a main assembly on the inlet camshaft which is designed to alter the angular position of the shaft in relation to the drive pulley.

There is also a valve, operated by a solenoid, both of which are located on the inlet manifold and are hydraulically connected to the main assembly by means of ducts.

The operating principle is as follows:

- at coolant temperatures below 40 °C and when the engine is idling or the speed exceeds a certain level, the solenoid (1) is de-energized therefore the valve body (2), thrust by the opposing spring (3), remains raised not allowing the oil, which arrives from the duct (A), to reach the transformer.
  In this case the timing of the inlet valves remains unchanged.
  When the temperature of the coolant is above 40 °C and the engine speed is below a certain level, when the butterfly angle is greater than about 8°, the solenoid (1) is energized, pushing the valve chest (2) downwards. In this position the oil, coming from the duct (A), enters the piston chamber (B) and, from there, flows through a special port to the duct (C) inside the latter.
  The oil can only escape from the above chamber through the upper port (in contact with duct (D) supplying oil to the transformer) because as the valve body (2) is lowered, the lower port is not in contact with the drainage duct (E).
  Through ducts (D) and (F) the oil reaches the chamber (G) moving the piston (4) axially towards the engine; as a result of this axial movement the piston, which has helical teeth on the outside, is forced to rotate in a clockwise direction (as seen from the timing side).
  Its rotation is transmitted, by means of a straight-toothed splined profile, to the pinion (5) which, bolted onto the threaded end of the camshaft (6), transmits the rotation to the shaft, thereby altering the timing of the inlet valves with a 9° advance.

When the solenoid is de-energized, the valve body (2) returns to the original position, cutting off the fuel of oil under pressure to the chamber (G), but allowing the return of the oil to the exhaust, thanks to the force of the opposing spring (7).

An additional duct ensures the lubrication of the camshaft bearing even when the device is not activated.

The oil which escapes and reaches the solenoid chamber (H) is drained through the drainage duct (E).

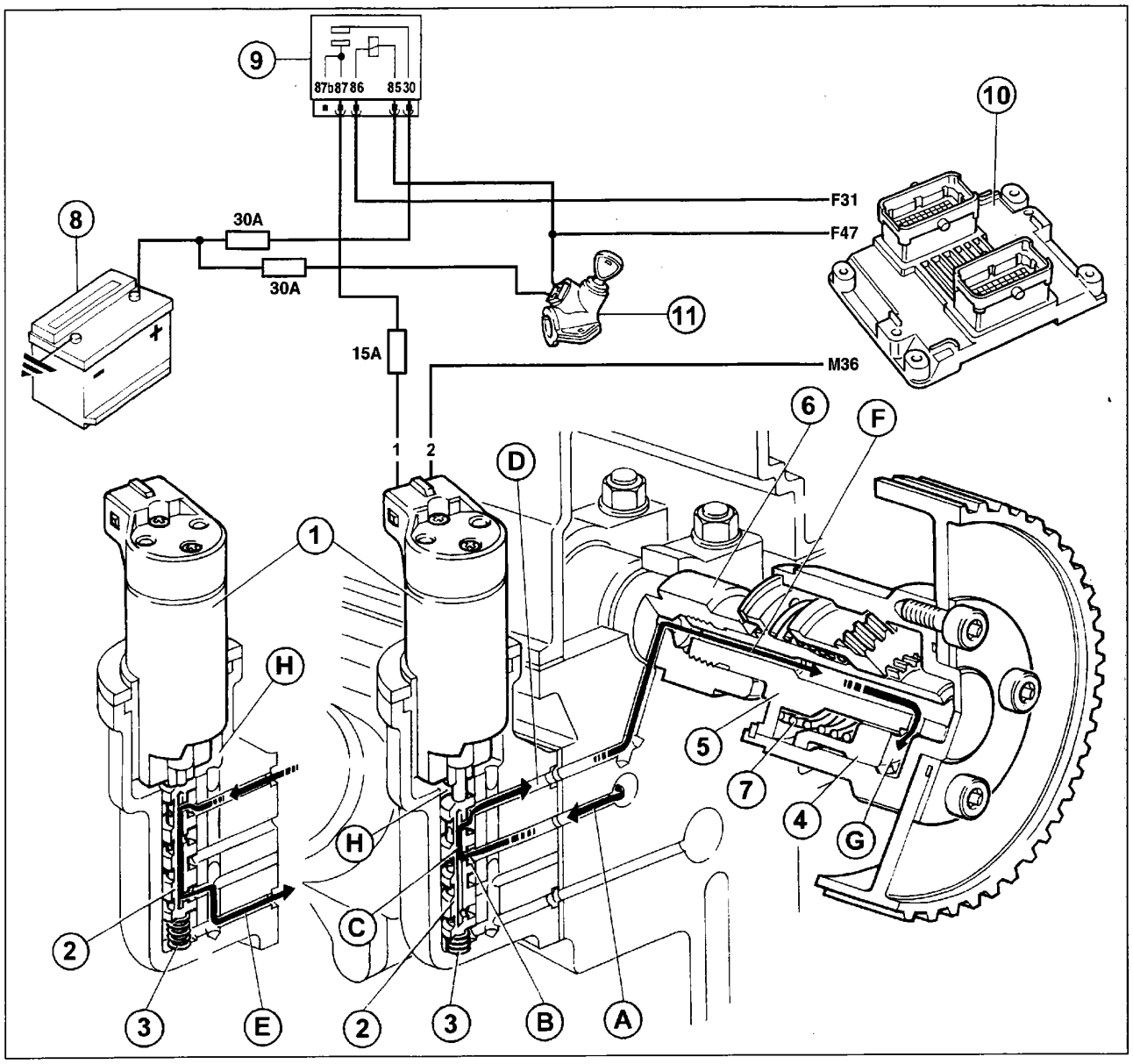
### Recovery

If the solenoid valve fails, the control unit final stage (driver) is deactivated.



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## Diagram showing operation of phase transformer

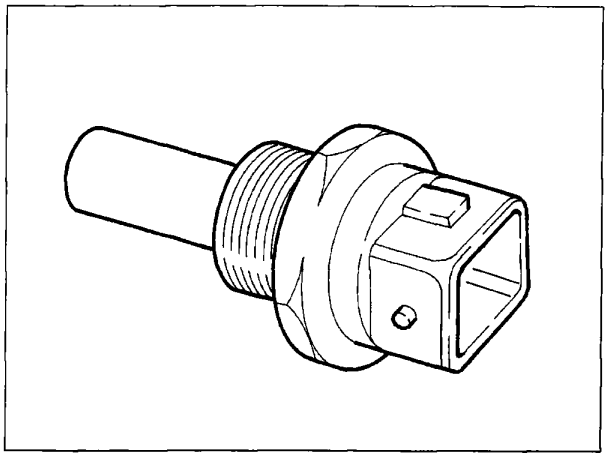



4A33LJ01

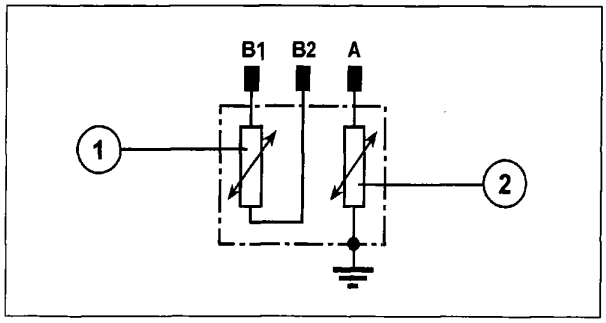
1. Solenoid
2. Valve chest
3. Valve chest spring
4. Piston
5. Pinion
6. Camshaft element
7. Piston spring
8. Battery
9. Injection/ignition system relay
10. Injection/ignition control unit
11. Ignition switch



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4A34LJ01



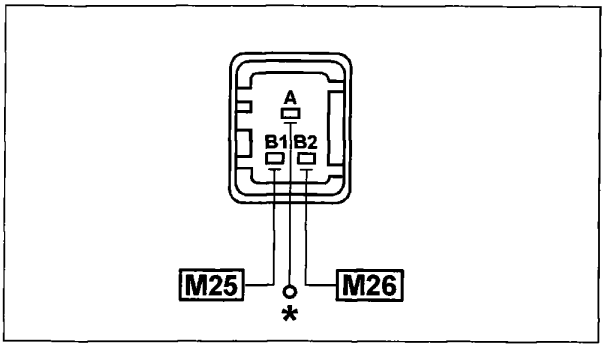

4A34LJ02

**INJECTION NTC**

| | Ω | °C | Ω |
|---|---|---|---|
| -20 | 15970 | 40 | 1150 |
| -10 | 9620 | 50 | 807 |
| 0 | 5975 | 60 | 576 |
| 10 | 3816 | 70 | 418 |
| 20 | 2500 | 80 | 309 |
| 25 | 2044 | 90 | 231 |
| 30 | 1679 | 100 | 176 |

**INSTRUMENT NTC**

| °C | Ω |
|---|---|
| 60 | 512-602 |
| 90 | 184-208 |
| 120 | 76-88 |




4A34LJ03

* Connection to the engine coolant temperature gauge in the instrument panel

## ENGINE COOLANT TEMPERATURE SENSOR

(Jaeger 402.183.01)
(Elth 2690350)

This sensor is fitted on the thermostat casing; it comprises a brass casing which affords protection to the actual resistive elements consisting of two NTC (Negative Temperature Coefficient) type thermistors where the electrical resistance of the sensor decreases as the temperature increases. The two NTCs are distinct and provide information concerning the temperature to the specific gauge in the instrument panel and to the injection/ignition control unit. The reference voltage for the NTC element for the injection system is 5 Volt becuse the control unit intake circuit is designed as a voltage divider so this voltage is divided between a resistance in the control unit and the sensor NTC resistance. As a result the control unit is capable making evaluations through the changes in the voltage and thereby obtain information concerning the temperature.

1. Injection system NTC
2. Instrument panel gauge NTC

### Recovery

The last value measured or a fixed value of 80 °C is used if the temperature of the intake air is above a certain level. The self-adjustment of the mixture strength is inhibited. The radiator fan is activated. The self-adjustment of the idle is inhibited.

### Checking the resistance

The table at the side contains the resistance values for the NTC elements depending on the temperature. These values can be measured by disconnecting the connector and connecting an ohmmeter to the sensor pins.

### Removing-refitting

Disconnect the electrical connection and remove the sensor.

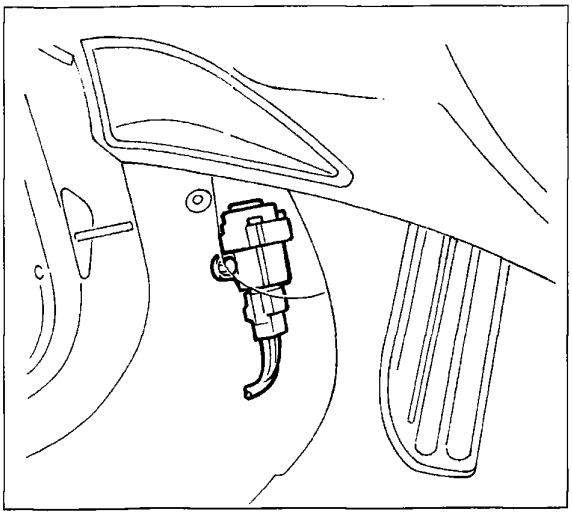
Tightening torque 2.2 daNm.

### Connector wiring

The numbers indicate the control unit pins.



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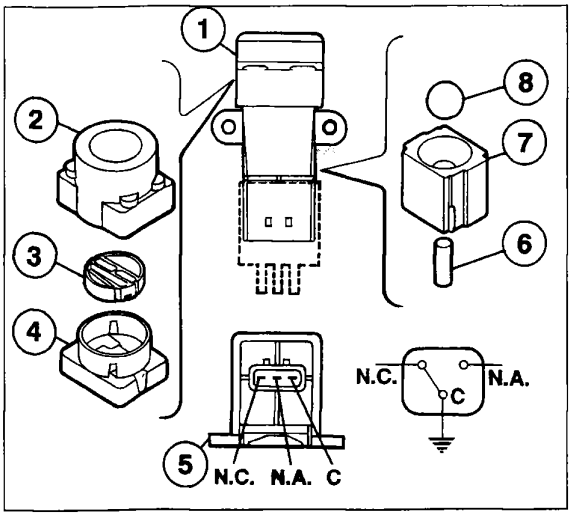


4A34JJ02

## INERTIA SWITCH

In order to improve the safety of the occupants of the vehicle in the case of an impact, the vehicle is equipped with an inertia switched located inside the passenger compartment, on the left panel under the dashboard on the driver's side.
This sensor reduces the risk of fire (as a result of the escape of fuel) by de-activating the auxiliary electric pump which supplies the injection circuit.
The inertia switch consists of a steel ball fitted in a (conical shaped) housing and kept in position by the attraction force of a permanent magnet.
In the case of a violent impact, the ball is released by the magnetic clip and opens the normally closed (NC) electrical circuit interrupting the connection to earth of the electric pump and consequently the injection system supply.
To restore the connection to earth for the auxiliary pump, the seat has to be moved back and the switch pressed until a click is heard.

*After even an apparently slight impact, if there is a smell of fuel or there are leaks from the fuel system, do not turn the inertia switch back on, but search first for the cause of the problem and remedy it to avoid the risk of fire.*




4A35LJ02

Inertia switch components

1. Complete inertia sensor
2. Outer casing
3. Button
4. Upper side
5. Engagement side
6. Permanent magnet
7. Permanent magnet housing
8. Steel ball

C. Common terminal
N.C. Normally closed contact
N.A. Normally open contact



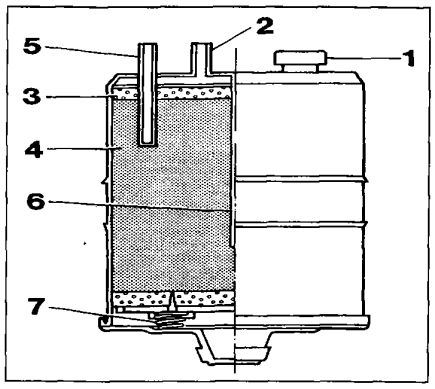
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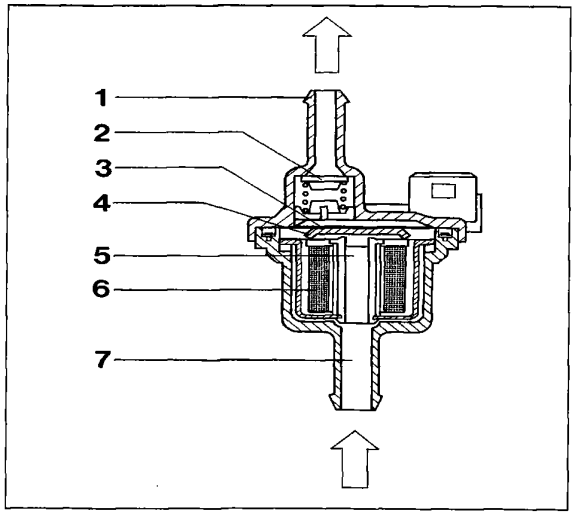
## ANTI-EVAPORATION SYSTEM COMPONENTS

### Charcoal filter and fuel vapour cut out solenoid valve

These components form part of the fuel vapour recovery and anti-evaporation system. The charcoal filter is located in the right wheel arch; to gain access to it the rear section of the right front wheel arch liner has to be removed.
The cut out solenoid valve is located in the engine compartment, under the inlet manifold.




4A36LJ01




4A36LJ02

1. Inlet connector
2. Single-acting valve
3. Spring
4. Shutter
5. Outlet port
6. Solenoid
7. Outlet connector

### Charcoal filter

It consists of granules of charcoal (4) which trap the petrol vapours entering through the intake (5).
The scavenging air which enters through the intake (1), passes through the paper filter (3), comes into contact with the granules of charcoal and removes the petrol vapours and directs them towards the outlet (2) and from there to the cut out solenoid valve.
The air, entering through the intake (5), can also be recalled by the vacuum in the tank and used for ventilation purposes. The partition (6) ensures that the air introduced comes into contact with all the granules of charcoal facilitating the release of the petrol vapours to the inlet manifold.
There are also two springs (7) which allow the expansion of the mass of granules when the pressure increases.

### Vapour cut out solenoid valve (0.280.142.340)

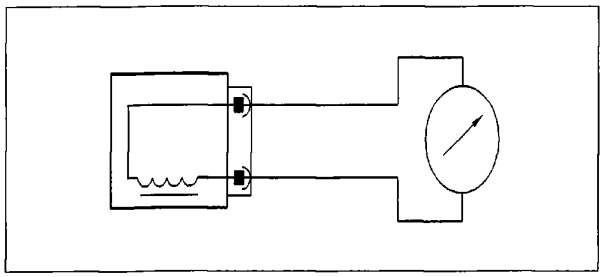
The function of this valve is to control the quantity of petrol vapours drawn in by the charcoal filter and directed to the inlet manifold which is achieved through the electronic control unit.
If this valve is not supplied it is in the open position; when the key is turned to the **ON** position, it closes and prepares for operation. In effect, if energized, the solenoid (6) attracts the shutter (4) which, overcoming the loading of the spring (3), closes the port (5), preventing the flow of petrol vapours.
The operation is controlled by the electronic control unit as follows:
- during starting, the solenoid valve remains closed, preventing the petrol vapours from excessively enriching the mixture;
- with the engine started up, the electronic control unit sends a signal to the solenoid valve which modulates the opening.

In this way the control unit controls the quantity of petrol vapours sent to the inlet, avoiding considerable variations (above all during idling) in the mixture strength.

**NOTE** *The solenoid valve must be fitted in the correct position: the arrow on the casing should be pointing towards the vacuum intake on the inlet manifold.*



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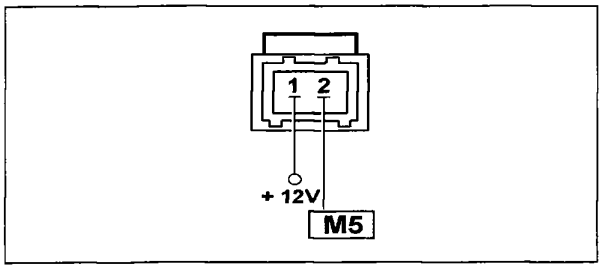


4A37LJ01

### Checking the resistance

The resistance of the solenoid valve can be measured by disconnecting the connector and connecting an ohmmeter as illustrated in the diagram.

**Resistance: 17.5-23.5 ohm at 20 °C**




4A37LJ02

### Connector wiring

The numbers indicate the corresponding control unit pins.

## CHECKS, ADJUSTMENTS AND REPAIR OPERATIONS ON THE BOSCH MOTRONIC ME 3.1 INJECTION/IGNITION SYSTEM IN ADDITION TO THE FAULT DIAGNOSIS

*WHEN WORKING ON VEHICLES EQUIPPED WITH MOTRONIC INJECTION/IGNITION SYSTEMS, FOLLOW THESE PRECAUTIONS:*

- *do not start up the engine with the electrical connections not properly connected or the battery terminals slack;*
- *do not use a rapid battery charger to start the engine;*
- *never disconnect the battery from the system with the engine running;*
- *to carry out the rapid charging of the battery, disconnect it first from the system;*
- *if the vehicle is going into a drying oven after painting, at temperatures in excess of 80 °C, the injection/ignition electronic control unit must be removed first;*
- *do not connect or disconnect the electronic control unit multiple connector with the ignition switch in the ON position;*
- *always disconnect the negative battery lead before carrying out electrical welding on the vehicle.*

*It should be remembered that this system has a memory which is always supplied (stand-by memory) which contains the self-adjustment values. Disconnecting the battery means that this information will be lost and can only be acquired again after a certain length of time therefore this operation should be carried out as infrequently as possible.*



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# 10.

## ENGINE IDLE SPEED CONTROL

If the engine idle speed is not 750±50/min and the injection/ignition control unit is the self-adjusting type then it is not possible to carry out any adjustments so it is necessary to check that the accelerator linkage is correctly adjusted and the cause of the problem should be sought by carrying out a complete fault diagnosis using the diagnostic equipment.

## CHECKING THE CONCENTRATION OF POLLUTANT EMISSIONS

Through the self-adjustment of the system, the Motronic ME 3.1 system guarantees a continuous check on the idle speed and the **CO** percentage making any other external adjustment operation superfluous (there are no longer any adjustment screws). However, a check on the content of the exhaust gases, downstream of the catalyzer, can provide precious information on the operating conditions of the injection/ignition system, the engine parameters and the catalyzer.

### Checking idle concentration of CO and HC upstream of the catalytic silencer

To check the concentration of carbon monoxide (**CO**) and unburnt hydrocarbons (**HC**), upstream of the catalyzer, proceed as follows:

1. Undo the plug or the nut on the exhaust pipe, upstream of the catalyzer, and tighten the tool in its place.
2. Connect a suitably calibrated **CO** tester probe to the tool.
3. Start up the engine and let it reach operating temperature.
4. Check that the speed corresponds to the recommended figure.
5. Check that the **CO** idle concentration is within the recommended limits given in the table overleaf; if this is not the case, it is necessay to check:
   - that the Lambda sensor is working properly, using the diagnostic equipment;
   - for the presence of air penetration in the area surrounding the Lambda sensor housing;
   - the injection and ignition system ( in particular the wear of the spark plugs ).
6. Under the same circumstance, check that the concentration of **HC** is below 600 p.p.m.
7. If these values are not found, proceed with tuning the engine, in particular checking: the ignition advance angle - the valve clearances - the valve gear timing - the engine compression.



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## Checking exhaust concentration of CO and HC

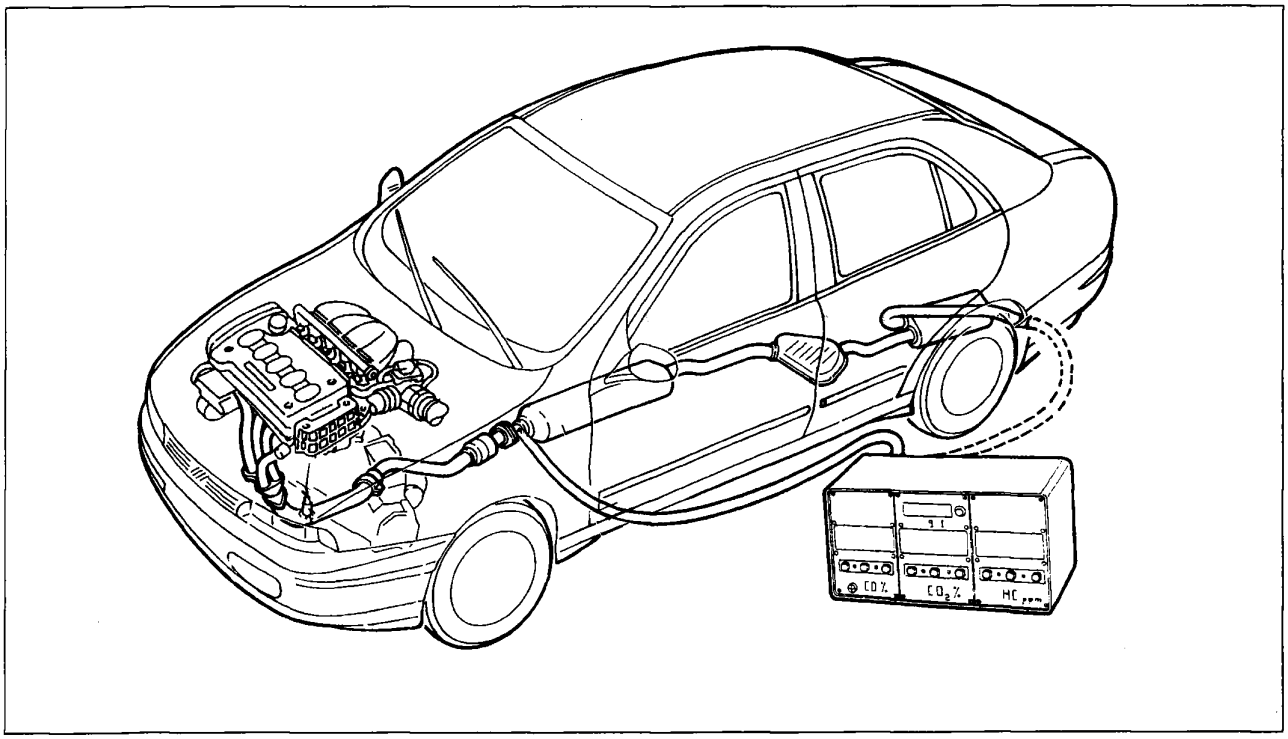
The exhaust concentration of carbon monoxide (CO) and unburnt hydrocarbons (HC) is meaured by inserting a suitably calibrated CO tester probe at leat 30 cm into the end of the exhaust pipe as illustrated in the diagram.

If the shape of the end section of the exhaust pipe does not allow the sensor to be fully inserted, a special extension pipe which ensure the seal in the join area must be added.

1. Check that the idle CO and HC concentration figures correspond to those in the table.
2. If the HC value is different from the recommended limit, whilst that measured previously upstream of the catalyzer was correct, the engine parameters are correct and therefore the cause of the problem should be sought in the decreased efficiency of the catalyzer.

## Table summarizing pollutant emission tolerance values

| | CO (%) | HC (p.p.m.) | $CO_2$ (%) |
|---|---|---|---|
| Upstream of the catalyzer | 0.4 - 1 | 600 | ⩾ 12 |
| Downstream of the catalyzer | ⩽ 0,35 | ⩾ 90 | ⩾ 13 |




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# 10.

## DIAGNOSTICS

The complete fault diagnosis of the system can be carried out through active dialogue with the diagnostic equipment.
If a failure at the sensors is detected, the electronic control unit replaces the information coming from the faulty sensor with pre-memorized (recovery) data to allow the operation of the engine. The detection of a fault involves it being permanently stored in the memory and the sensor excluded from the system until the signal is compatible again.
The same procedure is applied if the fault involves an actuator or control flap. The detection of a fault and its replacement with recovery data means that the fault will be signalled by the special warning light in the instrument panel coming on.
The following parameters can be managed by the control unit in the case of a breakdown: flow meter, engine coolant temperature sensor, butterfly casing actuator, Lambda sensor, air temperature sensor, battery voltage and detonation sensors. If there are problems with the control unit, the rpm sensor or the electric fuel pump, the system does not identify the fault and the vehicle comes to a halt. The faults can be read by the operator on the control unit using the diagnostic equipment.

### Detecting faults

This is carried out during the basic function managing the sensor/actuator.

### Memorizing the error and structure of the errors memory

The errors are stored in the control unit memory in the order in which they occur. For each of them the location, type of error and ambient conditions (specific for each type of fault) measured at the time the error was detected are memorized and there is a frequency counter.

### Classification of the defect

If a defect is detected for the first time and the error state persists for a time t V 0.5s, then the defect is memorized as "permanent". If this defect later disappears, it is memorized as "intermittent" and "not present". If it then reappears, it remains memorized as "intermittent", but becomes "present".
The classification of a defect as "permanent" activates the recovery functions; when the fault disappears the normal reading or implementation function is restored.
Certain types of faults are classified as "important", i.e. in terms of pollution control regulations. The presence of these faults is signalled to the user by the failure warning light in the instrument panel coming on.

### Frequency counter

Each error is allocated a frequency counter which is used to determine the moment in which a fault memorized is no longer present. The first time the fault is detected, the counter is set at 10. If the fault disappears, the counter remains at the current value. If it reappears, it is increaed by 1 (with an upper limit of 50).
The counter is decreased each time the engine is started up and the fault has not reappeared. If the counter reaches zero, the fault is automatically cancelled from the memory.
If after the counter has decreased, the fault reappears, the counter is returned to a value of 10 (if, on the other hand, it was already above 10, it is not altered).

### Fault signalling

The failure warning light comes on when there is a defect memorized as "present" and "important".
There is a delay of 0.1 seconds between the detection of the fault and the warning light coming on; the delay between the fault disappearing from the memory and the warning light going out is 4 seconds.
The warning light comes on each time the ignition key is turned to the **ON** position. If there are "important" faults already present, the warning light goes out after 4 seconds.



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### Cancelling the error

When the frequency counter reaches 0, the fault and the parameters associated with it are cancelled.

The immediate cancellation of the entire errors memory takes place through the "cancelling errors memory" command sent by the diagnostic equipment.

### Connection with the diagnostic equipment

The diagnostic socket to which the diagnostic equipment (Examiner or SDC) is connected is located at the front right of the engine compartment (see diagram on page 18).

The exchange of data between the control unit and the diagnostic equipment takes place via a two-way serial line (line K) using the standard Bosch communication protocol.

The diagnostic equipment can provide the following information:

- display of the engine parameters;
- display of the errors;
- active diagnosis.

### List of errors

| Description | Nature of the errors |
|---|---|
| Rpm sensor | Signal loss |
| Air temperature sensor | Implausible signal |
| Coolant temperature sensor | C.A-C.C. |
| Battery | Implausible voltage |
| Lambda sensor | C.C. |
| Injector | C.A.-C.C. |
| Butterfly casing actuator | Implausible potentiometer signal |
| Petrol vapour solenoid valve | C.C. |
| Actuator relays | C.A.-C.C. |
| Control unit | Operating problems with the microprocessor or the control unit memories are signalled. |
| Flow meter | Signal not plausible |
| Timing sensor | Signal not plausible |
| Detonation sensor | Signal not plausible |
| Speedometer sensor | Signal missing or not plausible |
| Phase transformer | C.C. |
| Electric fuel pump | C.C. |
| Fiat-CODE | Code not recognized or not received |

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# 10.

## Parameters displayed

Engine rpm
Injection time
Advance
Intake air temperature
Engine coolant temperature
Butterfly valve opening angle
Battery voltage
Lambda sensor
Self-adjustment
Flow meter
Engine knock (detonation)
Vehicle speed
Petrol vapour cut out solenoid valve
Fiat-CODE
Atmospheric pressure

## Active diagnosis

The following active tests can be carried out using the diagnostic equipment:
- Phase transformer
- Injector
- Failure warning light
- Petrol vapour solenoid valve
- Air conditioning
- Idle speed actuator
- Cancelling errors

## Recovery

If there are failures at the senors, the control unit replace the value transmitted by the sensor which a so-called Recovery value which, depending on the different faults, is either stored in the control unit memory or specially reconstructed using other available information, to allow the vehicle to reach a service centre.

## Permanent memory

The control unit is equippd with a "permanent" type memory (EEPROM), in other words the error is preserved even if the cause of the problem no longer exists and the ignition has been switched OFF and a "volatile" type memory (RAM) which loses the error information as soon as the cause of the problem disappears.
This also allows the more effective identification of errors of an occasional nature.
Before ending the fault diagnosis, the contents of the "permanent" memory must be cancelled using the diagnostic equipment in Active Diagnosis.

The contents of the "permanent" errors memory must be cancelled as follows:

1. Using the diagnostic equipment in active diagnosis.
If this is not the case, when the diagnostic equipment is reconnected, the errors already examined will be signalled.
2. If the cause of the error no longer exists and the engine has been started 5 times (letting it run for at least 20 minutes) with at least 2 minutes between each time the engine is started up.

*Disconnecting the control unit from the system, even for very long periods, does not cancel the contents of the "permanent" memory.*



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## OPERATIONS ON VEHICLE

- Removing-refitting injectors 1
- Removing-refitting repair manifold 4
- Removing-refitting heater plugs 9
- Removing-refitting pressure pump 12
- Removing-refitting accelerator potentiometer 20
- Adjusting accelerator pedal end of travel 21
- Servicing instructions when removing turbocharger 22

Where the capacity is expressed, the validity of the operation only relates to the engine type specified.

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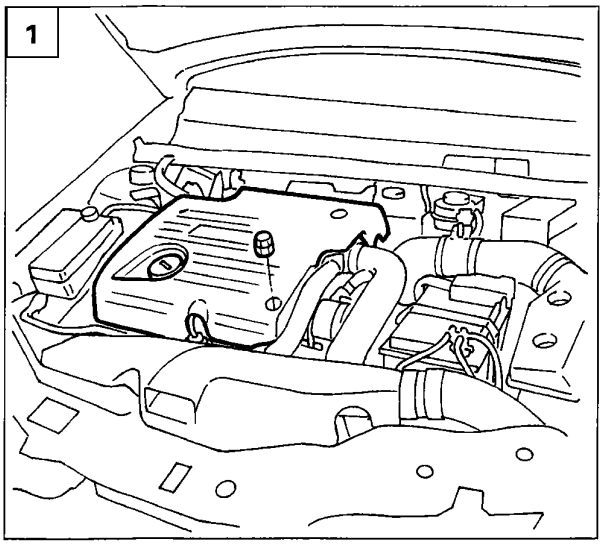
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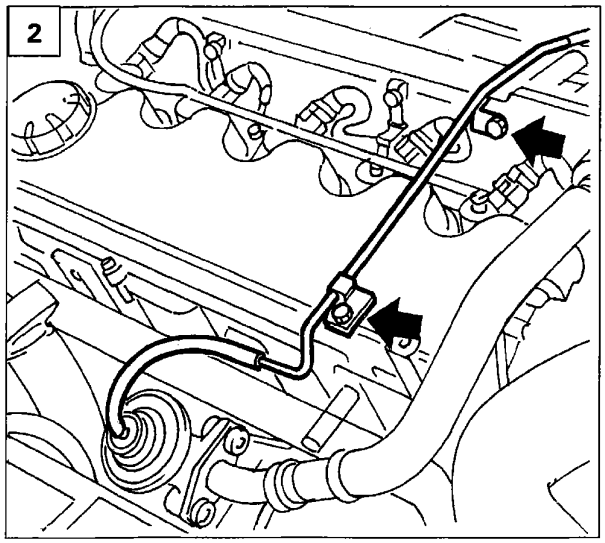
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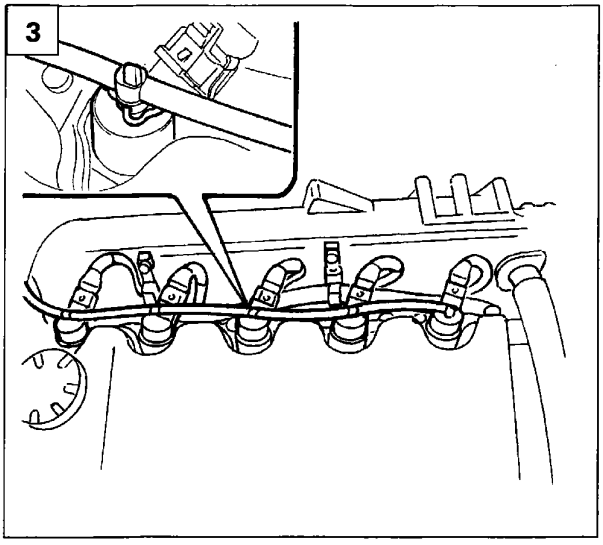
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P4F27MJ02




P4F27MJ03




P4F27MJ04

## REMOVING-REFITTING INJECTORS

- Disable the alarm (if fitted), located in the luggage compartment on the right hand side and disconnect the negative battery terminal.

1. Remove the upper engine protective cover.

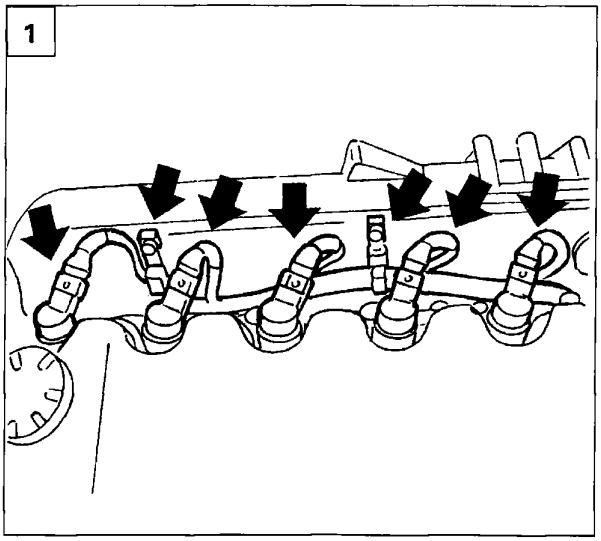
2. Undo the two bolts shown in the diagram and move the rigid pipe between the E.G.R. valve and the solenoid valve aside.

3. Disconnect the fuel return pipe from the injectors, acting on the spring.

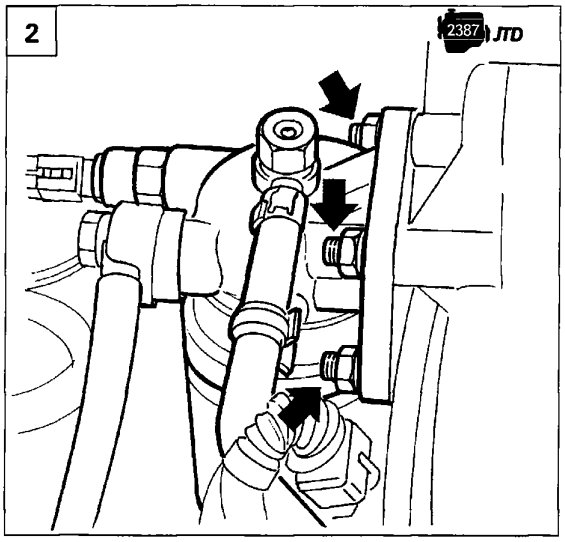


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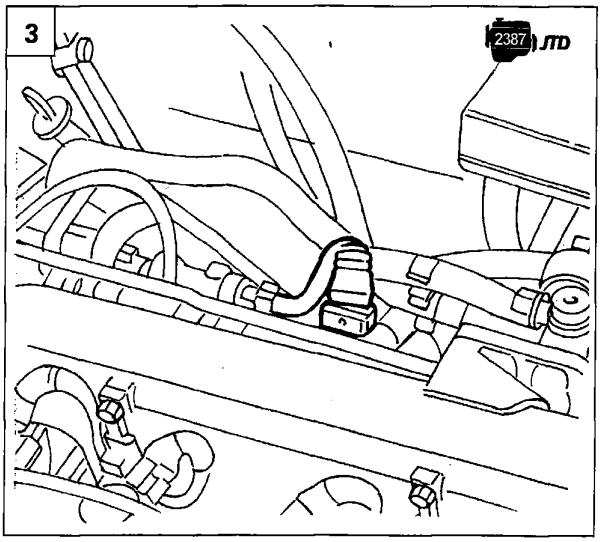
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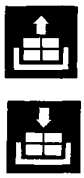

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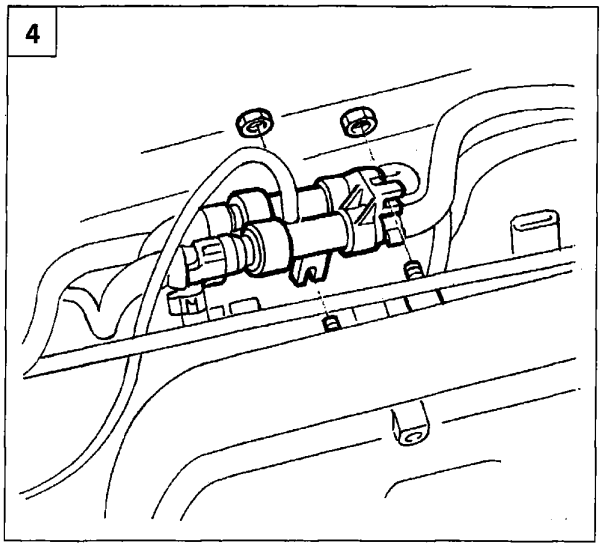

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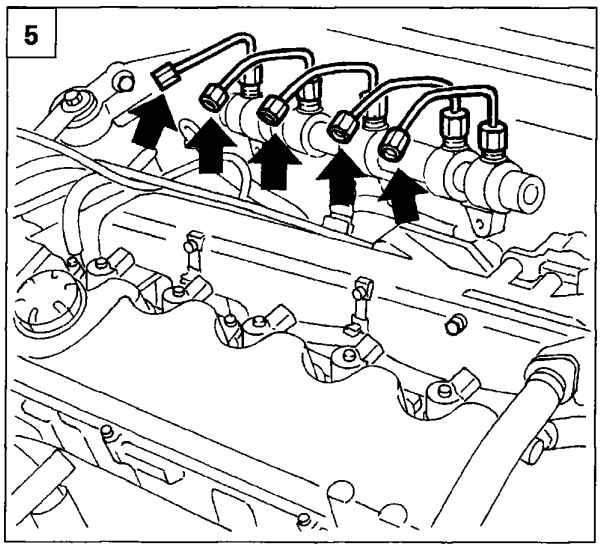

P4F28M J03



1. Disconnect the electrical connections from the injectors and move the wiring aside, undoing the two bolts as shown in the diagram.
2. Undo the fixing nuts and place the diesel filter to the side.
3. Disconnect the electrical connection from the excess pressure sensor.
4. Move the fuel return manifold aside.
5. Undo the injector side connectors for the pipes from the distribution manifold to the injectors.



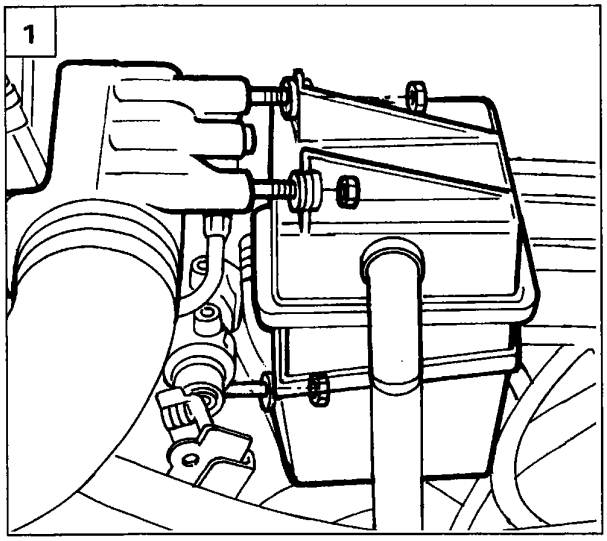

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P4F28M J05

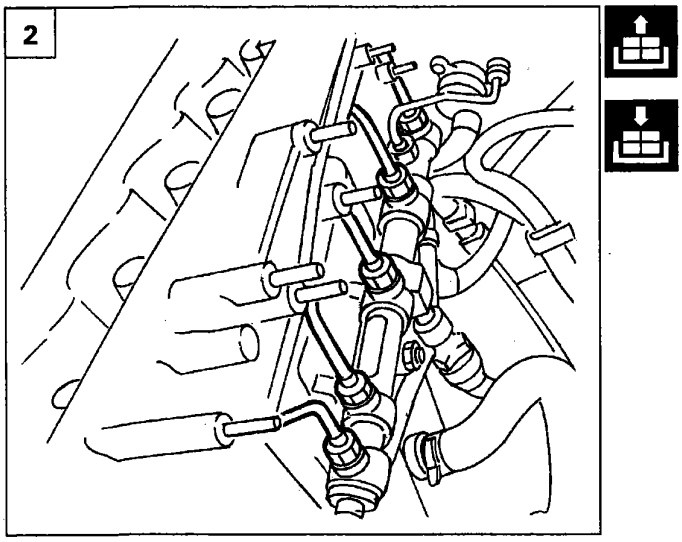


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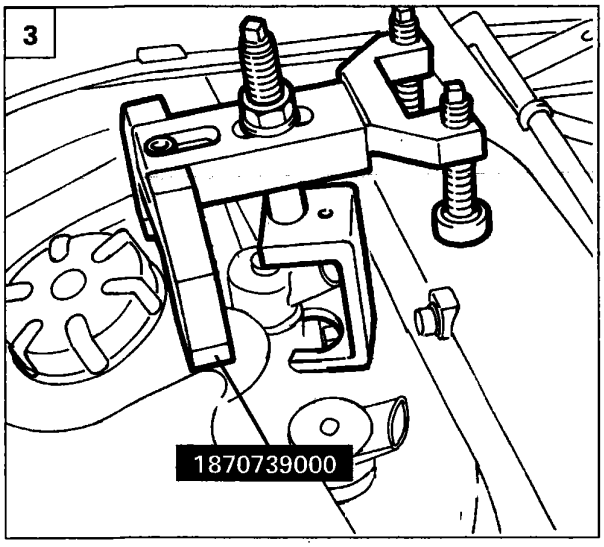

P4F29MJ01

1. Take off the oil vapour separator by unscrewing the three retaining nuts.




P4F29MJ02

2. Undo the manifold end pipe fittings from the rail leading to the injectors and remove them




P4F29MJ03

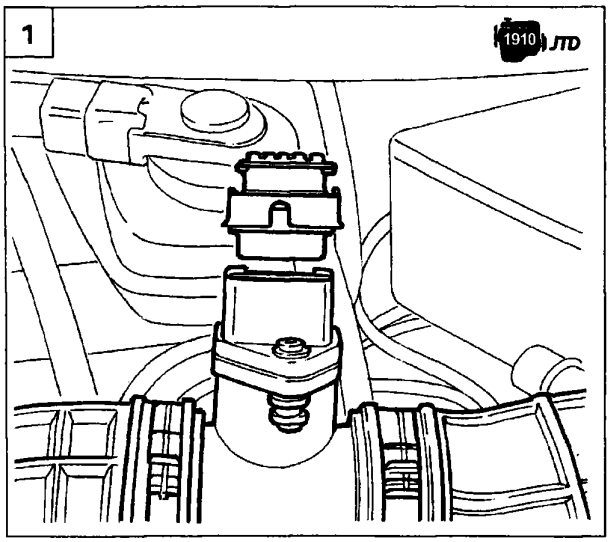
3. Undo the retaining nuts and carefully remove the injector bracket. Use tool 1870739000 to remove the injectors.

**NOTE** *To refit, carry out the above operations in reverse order and replace the washers underneath the injectors and the pipes joining the manifold and injectors. Manifold side and injector side pipe fittings must be tightened to a torque of 2.2 daNm.*

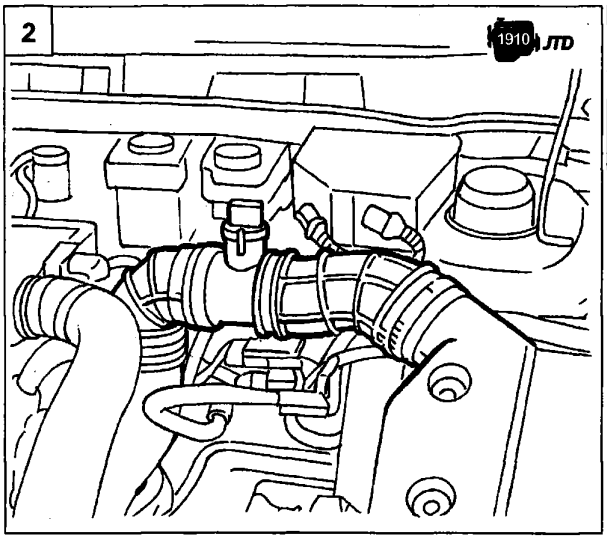


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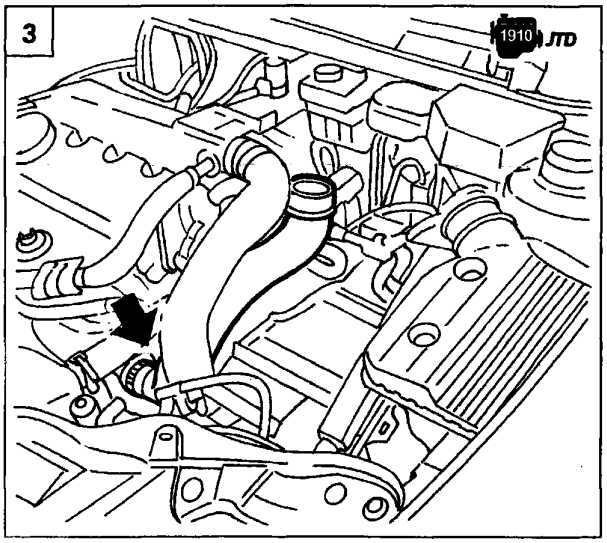
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P4F30MJ03




P4F30MJ04




P4F30MJ05

## REMOVING-REFITTING RAIL

- Disable the alarm (if present) by means of the switch under the junction unit cover.
- Disconnect the terminals and remove the battery (1920 JTD).

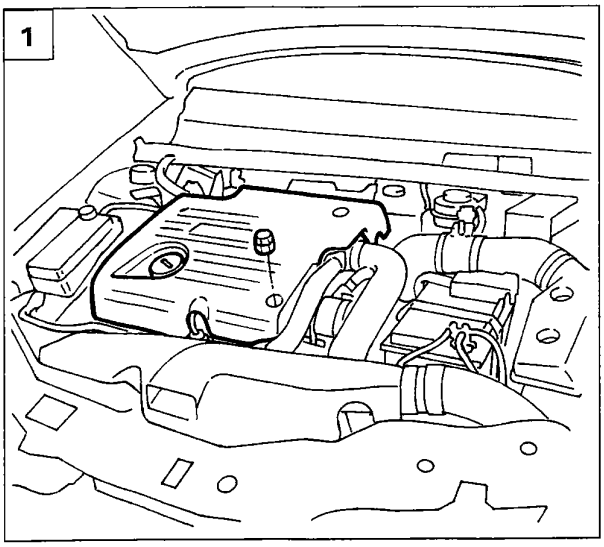
1. Disconnect the electrical connection for the flow meter.

2. Loosen the collars and remove the first pipe section between the air cleaner case and turbocharger.

3. Loosen the bands and remove the second pipe section between the air cleaner case and turbocharger.

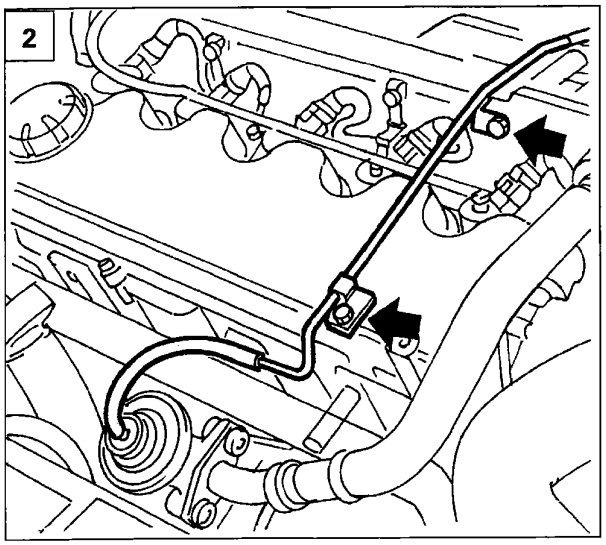


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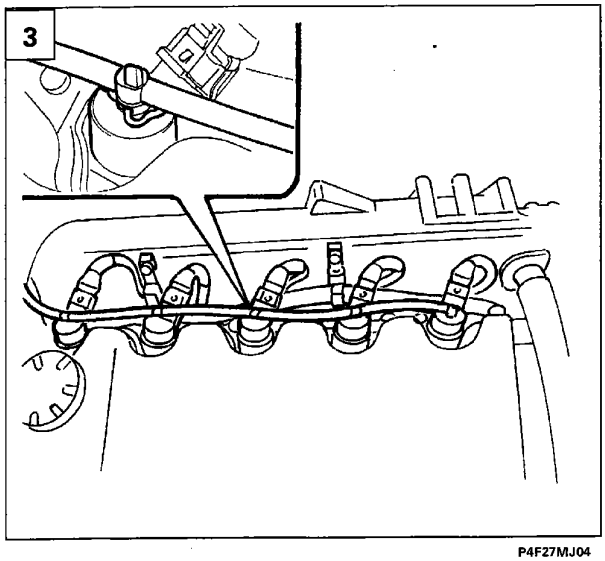

P4F27MJ02

1. Remove the upper engine protective cover.




P4F27MJ03

2. Undo the bolts and place the rigid pipe between the E.G.R. valve and the solenoid valve to the side.



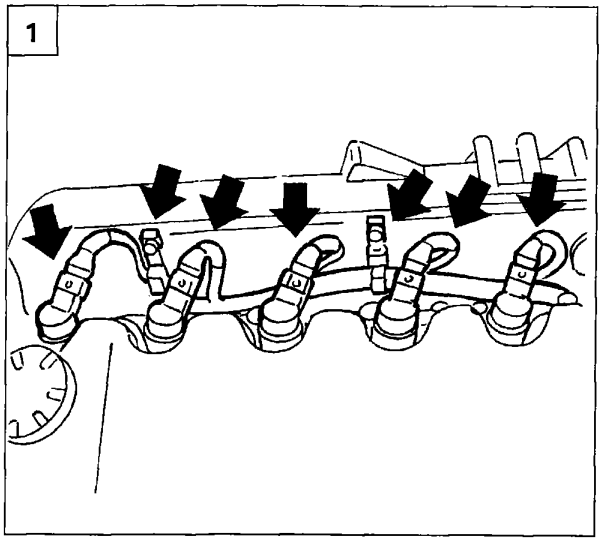

P4F27MJ04

3. Disconnect the fuel return pipe from the injectors.

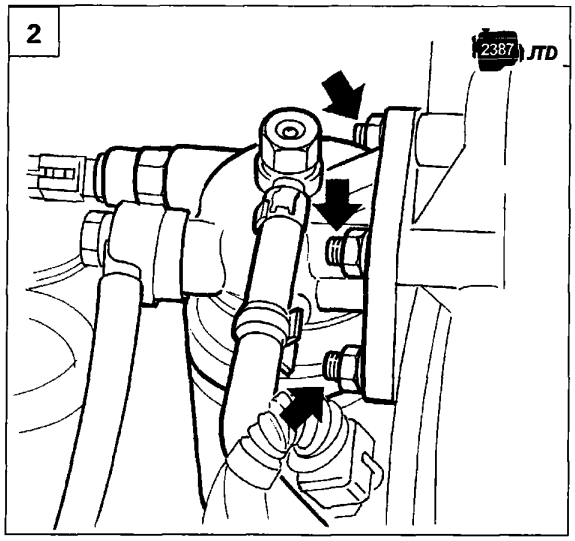


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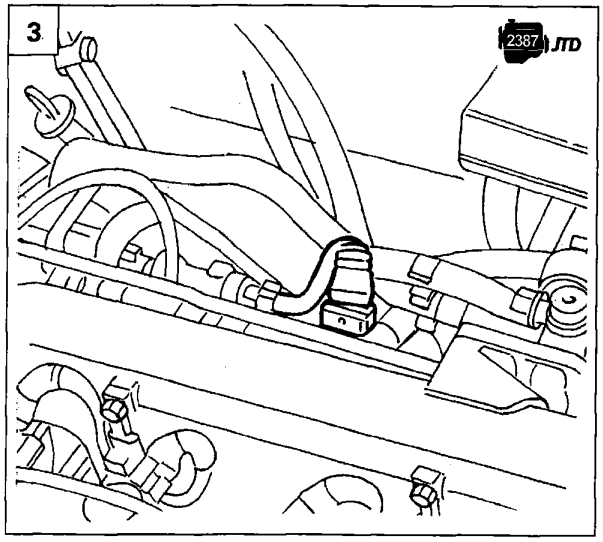
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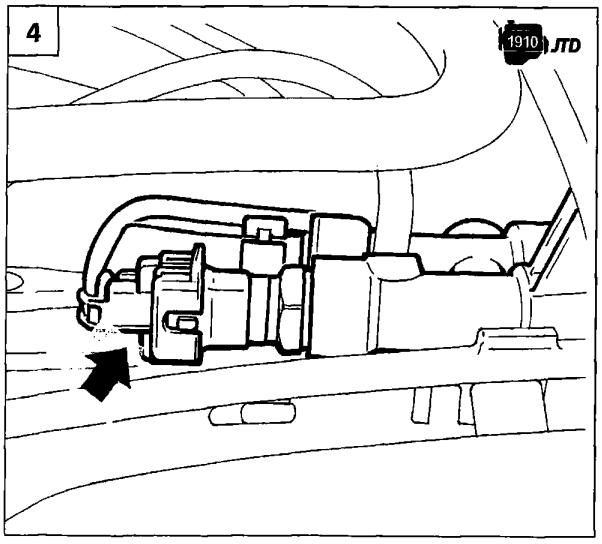



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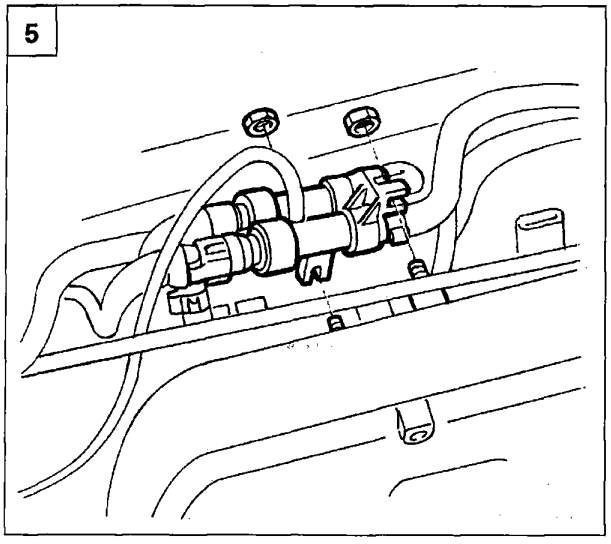



P4F28MJ03

1. Disconnect the electrical connections from the injectors and undo the fixing bolts and place the wiring to the side.
2. Undo the fixing nuts and place the diesel filter aside.
3. Disconnect the electrical connection from the excess pressure sensor.
4. Disconnect the electrical connection from the fuel temperature sensor.
5. Move the fuel return manifold aside.



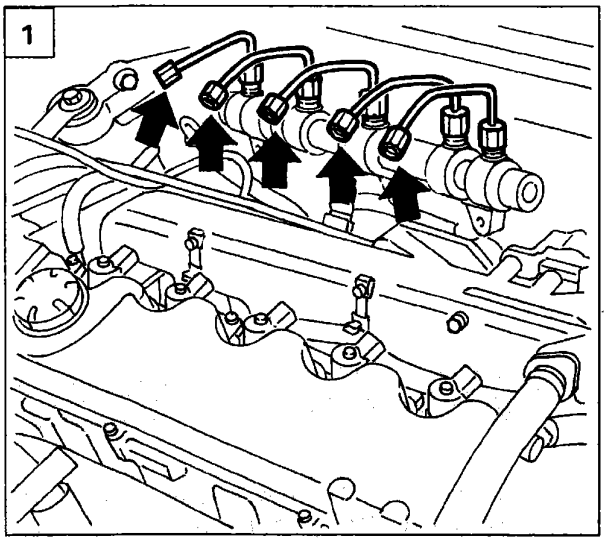

P4F32MJ01




P4F28MJ04

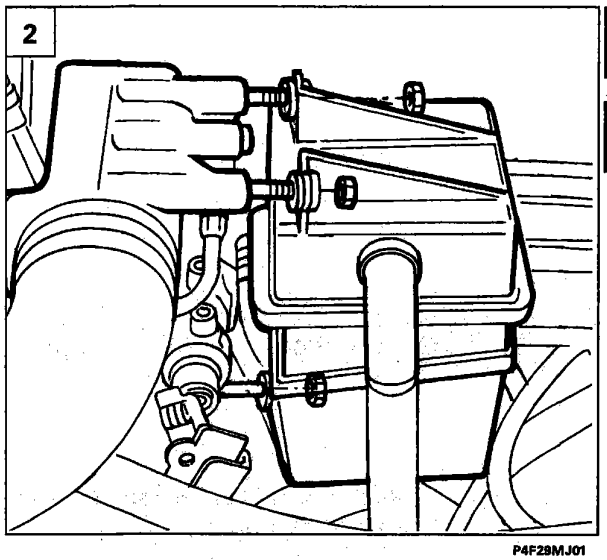


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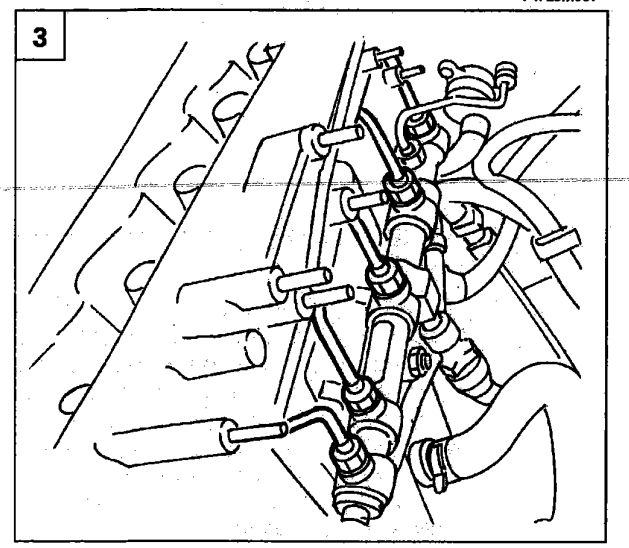

P4F28MJ06

1. Undo the injector end pipe fittings from the rail leading to the injectors.




P4F29MJ01

2. Remove the oil vapour separator by unscrewing the three retaining nuts.



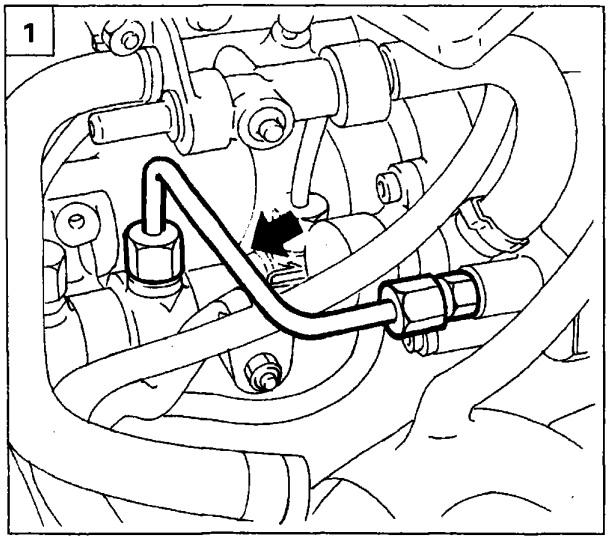

P4F29MJ02

3. Undo the manifold end pipe fittings from the rail leading to the injectors and remove them



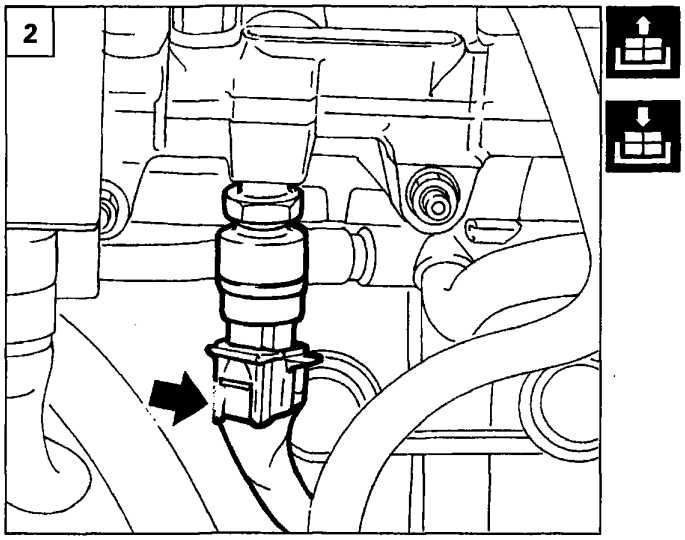
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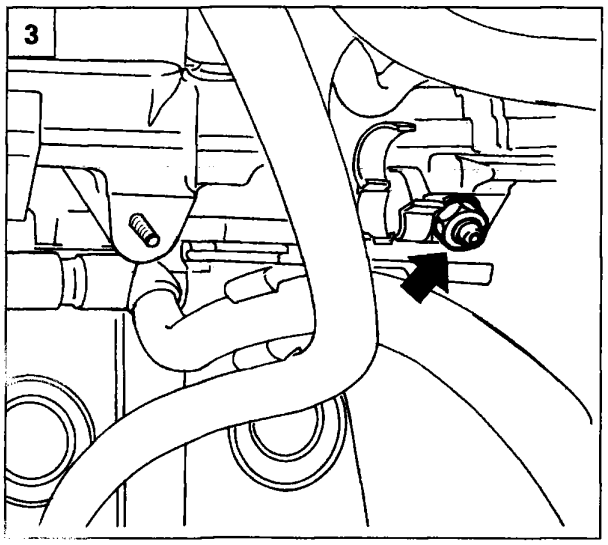

P4F34MJ01

1. Remove the fuel delivery pipe from the pressure pump to the rail pipe.




P4F34MJ02

2. Disconnect the electrical connection from the fuel pressure sensor




P4F34MJ03

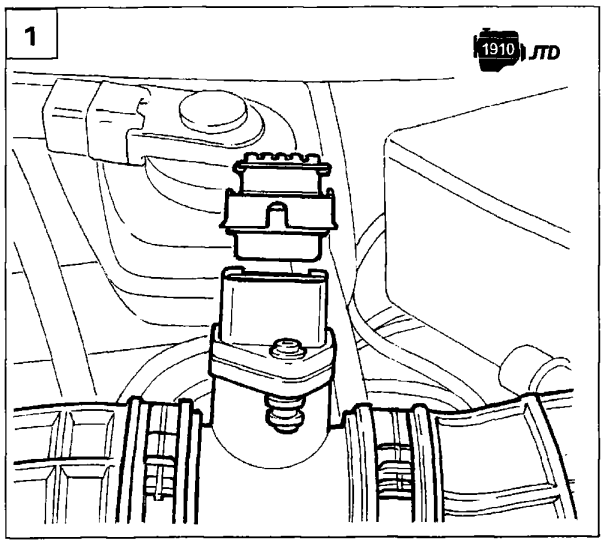
3. Unscrew the remaining nut securing the rail and remove.

**NOTE** *To refit, carry out the above operations in reverse order and replace the washers underneath the injectors, the pipes joining the manifold and pressure pump and the pipes joining the manifold and injectors. The manifold side and injector/pressure pump side pipe fittings must be tightened to a torque of 2.2 daNm.*



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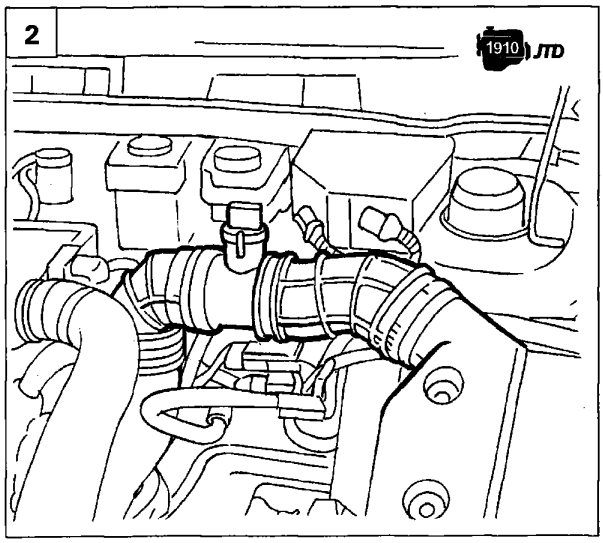
## REMOVING-REFITTING HEATER PLUGS




P4F30MJ03

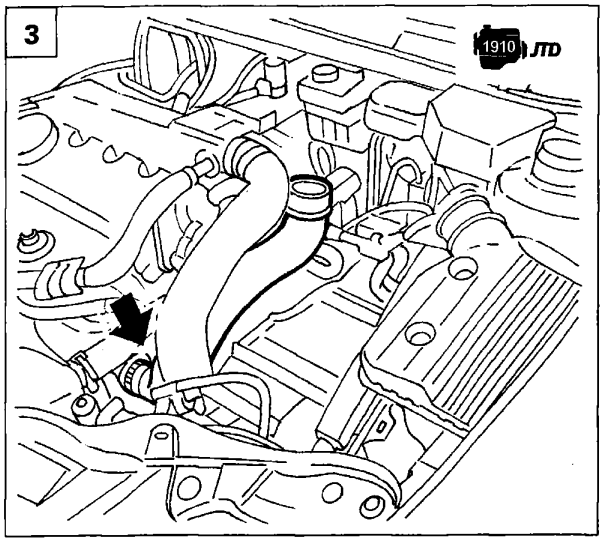
- Disable the alarm (if fitted) via the switch under the junction unit cover.
- Disconnect the terminals and remove the battery (1910 JTD).

1. Disconnect the electrical connection for the flow meter.




P4F30MJ04

2. Loosen the bands and remove the first section of the pipe between the air filter casing and the turbocharger.

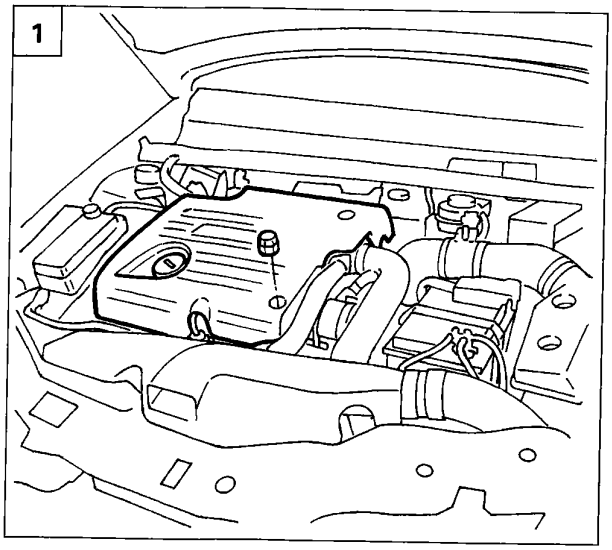



P4F30MJ05

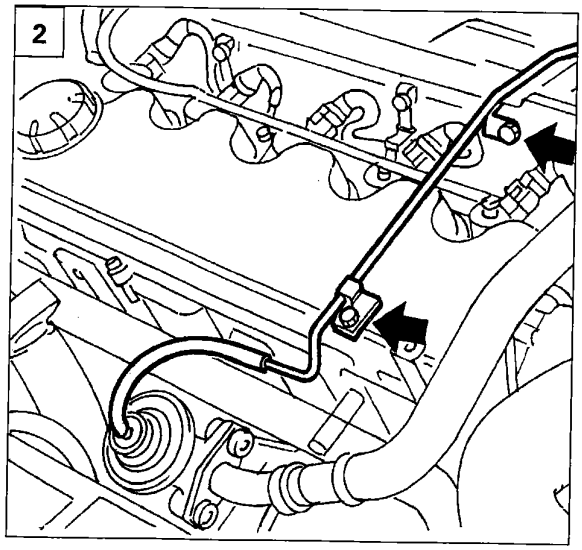
3. Loosen the bands and remove the second section of the pipe between the air filter casing and the turbocharger.



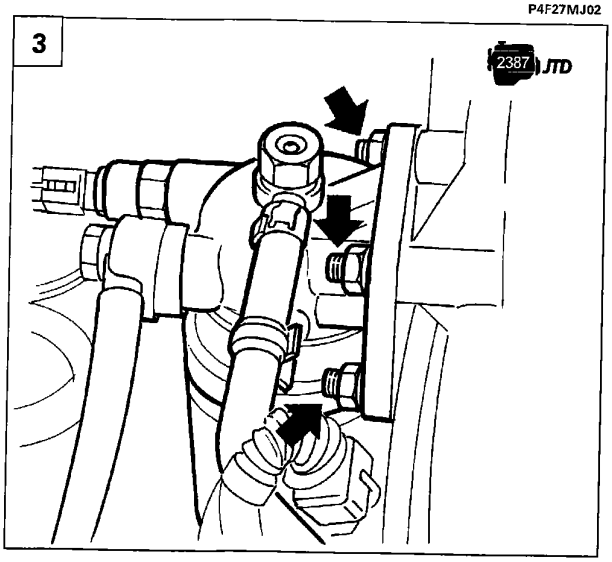
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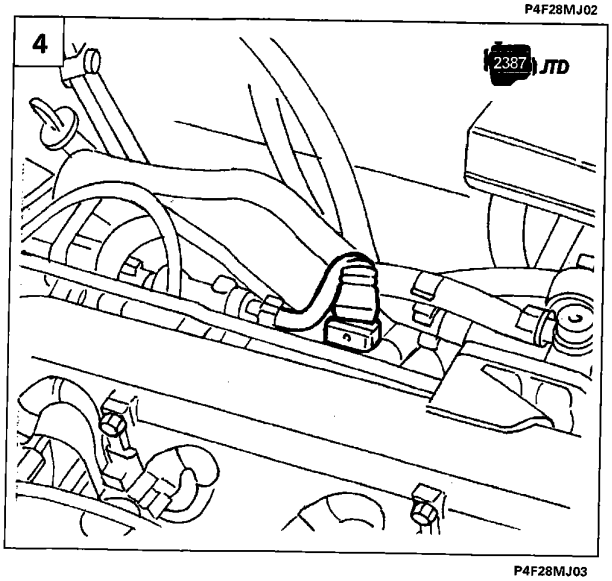



P4F27MJ03




P4F28MJ02

1. Remove the upper engine protective cover.
2. Undo the fixing bolts and place the rigid pipe between the E.G.R. valve and the solenoid valve to the side.
3. Undo the fixing nuts and place the diesel filter aside.

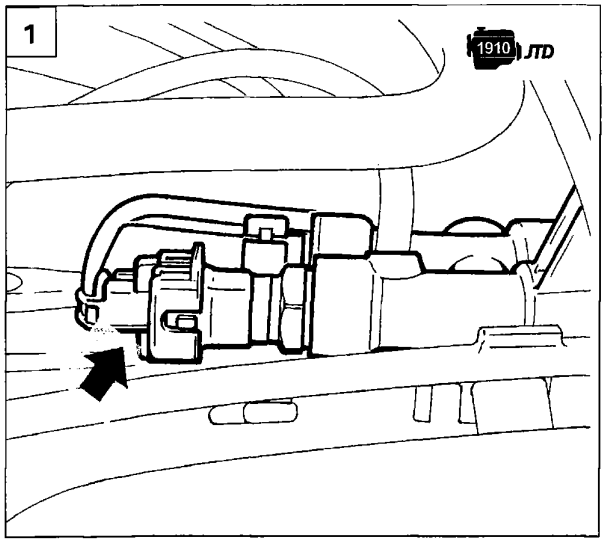



P4F28MJ03

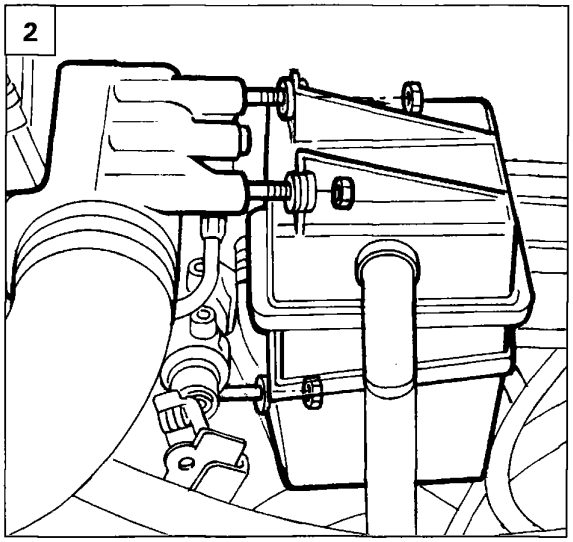
4. Disconnect the electrical connector from the excess pressure sensor.



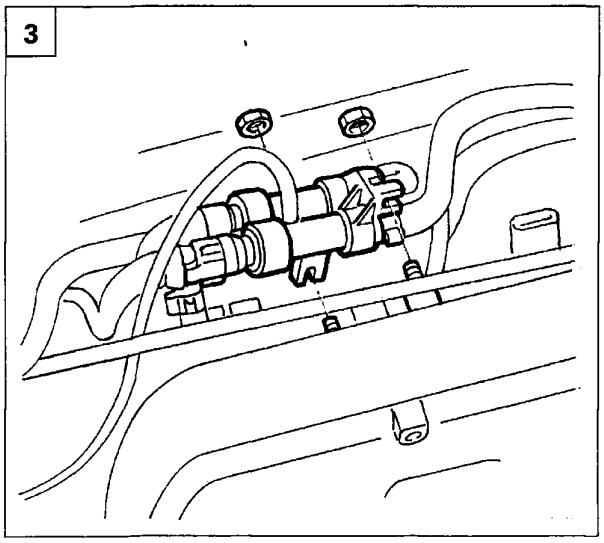
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P4F302MJ01

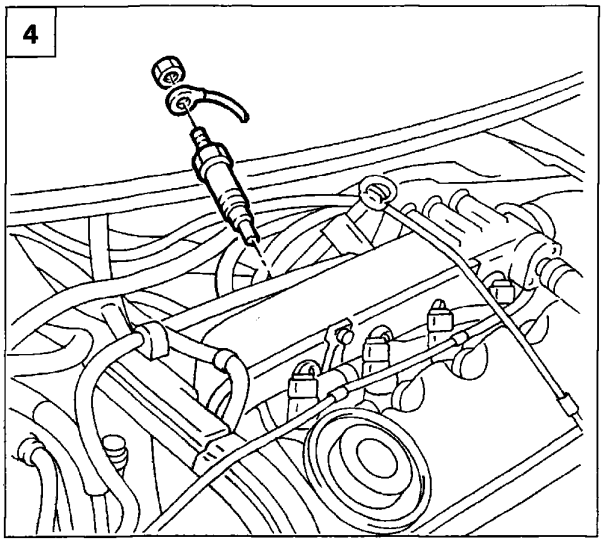



P4F29MJ01




P4F28MJ04

1. Disconnect the electrical connection from the fuel temperature sensor.
2. Move the oil vapour separator aside undoing the three fixing nuts.
3. Move the fuel return manifold aside.




P4F37MJ05

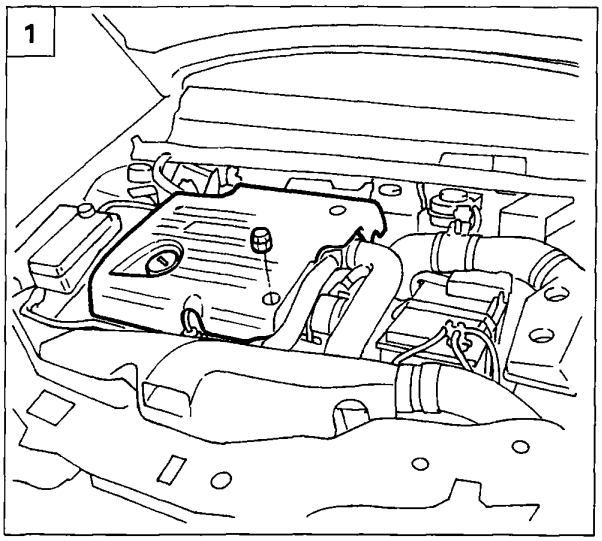
4. Disconnect the electrical connection undoing the fixing nut and remove the heater plugs using a suitable spanner.

**NOTE** *When refitting, carry out the procedures described above in the reverse order.*

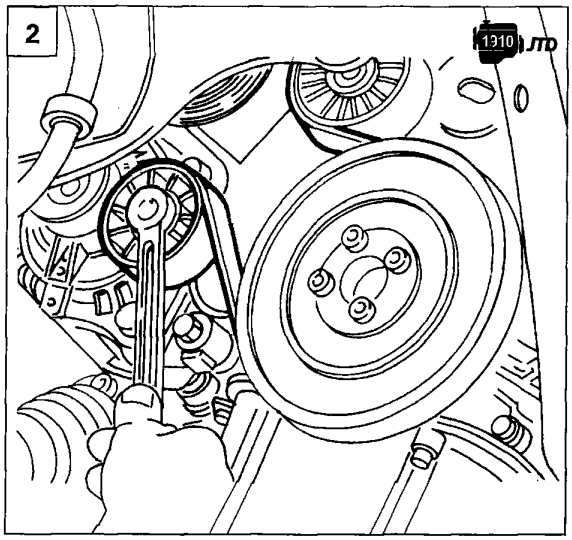


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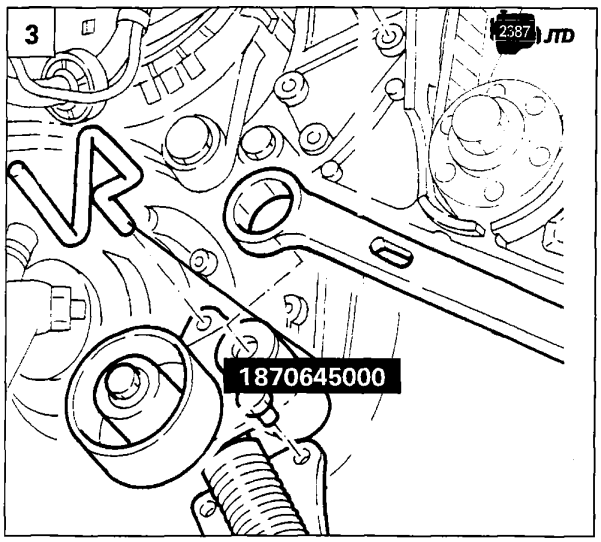
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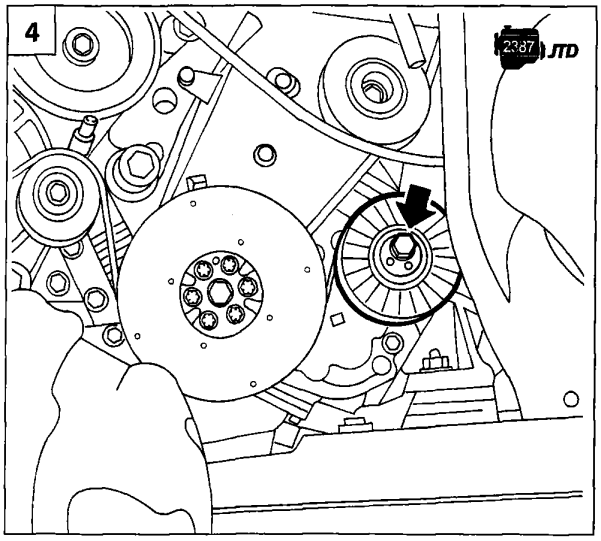

P4F27MJ02




P4F38MJ05




P4F38MJ04




P4F38MJ05

## REMOVING-REFITTING PRESSURE PUMP

Place the car on a lift.

- Disable the alarm (if fitted), located in the luggage compartment on the right hand side and disconnect the negative battery terminal.

1. Remove the upper engine protective cover.

- Remove the right front wheel and the wheel arch liner.

2. Act on the tensioning device to loosen the auxiliary shaft belt tension.

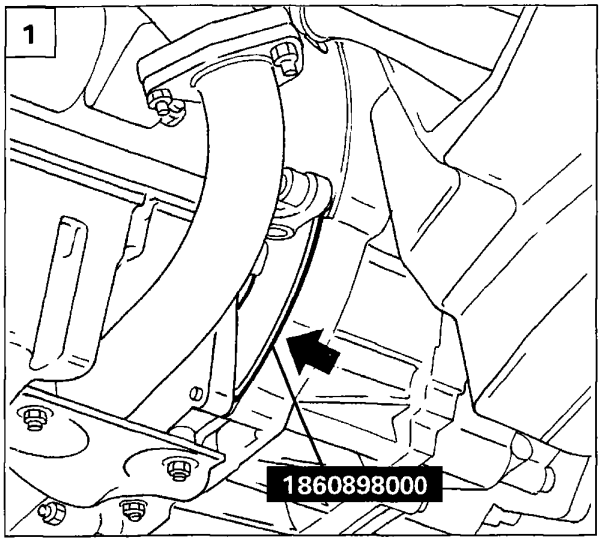
- Remove the auxiliary shaft belt (1910 JTD).

3. Rotate the tensioner until the reference opening in the actual tensioner coincides with the opening in the bracket; then insert tool 1870645000 in order to lock the tensioner in this position.

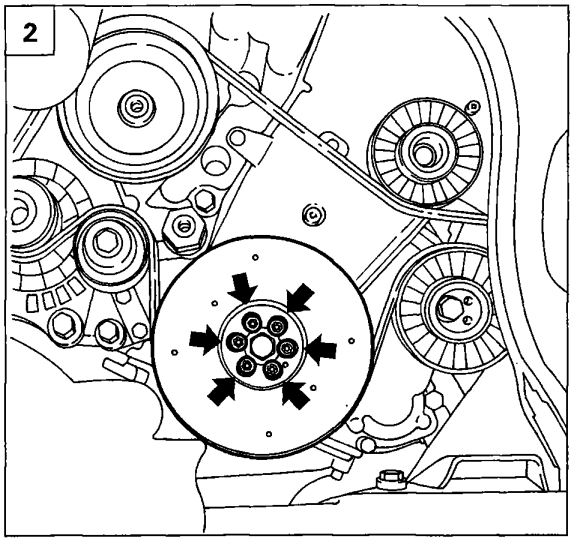
4. Loosen the tension of the moving pulley acting on the fixing bolt; then remove the auxiliary shaft drive belt.



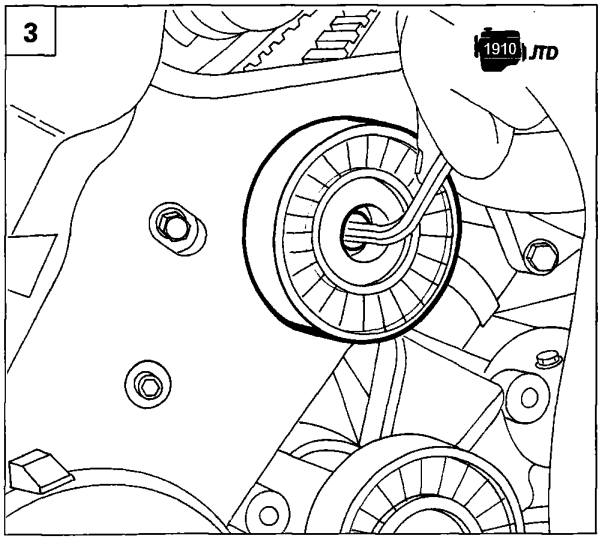
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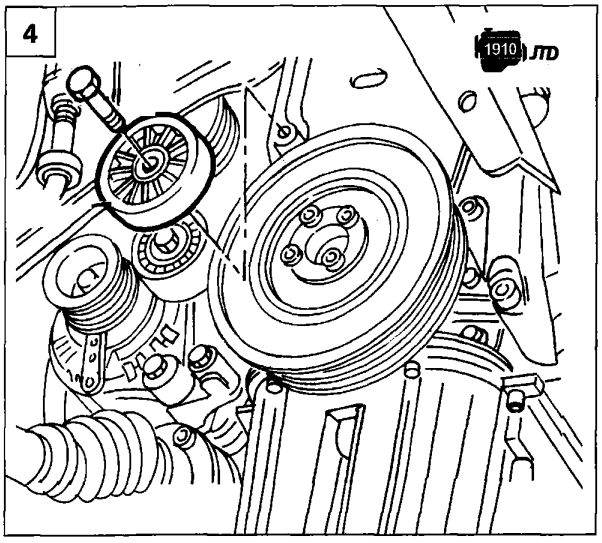



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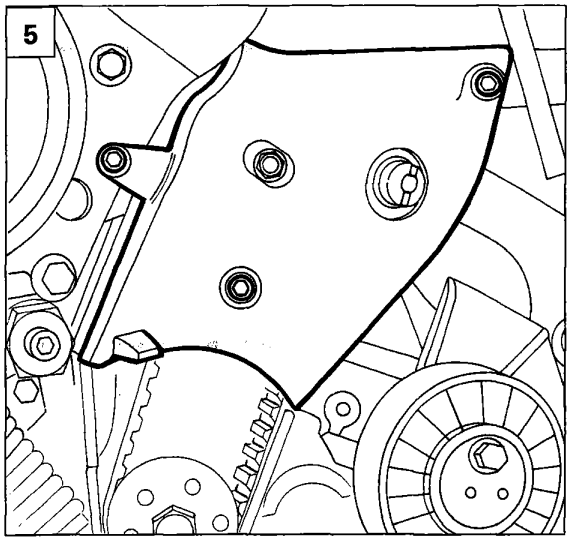



P4F39MJ03

1. Remove the lower engine shield and lock the flywheel using tool 1860898000.
2. Remove the auxiliary shaft drive pulley on the crankshaft (the pulley on the 1910 JTD engine has four fixing bolts).
3. Remove the auxiliary shaft belt idler fixed pulley to allow the subsequent removal of the lower timing belt shield.
4. Undo the fixing bolt and remove the single drive belt fixed tensioner.
5. Remove the lower timing belt shield and remove the flywheel lock.




P4F39MJ04

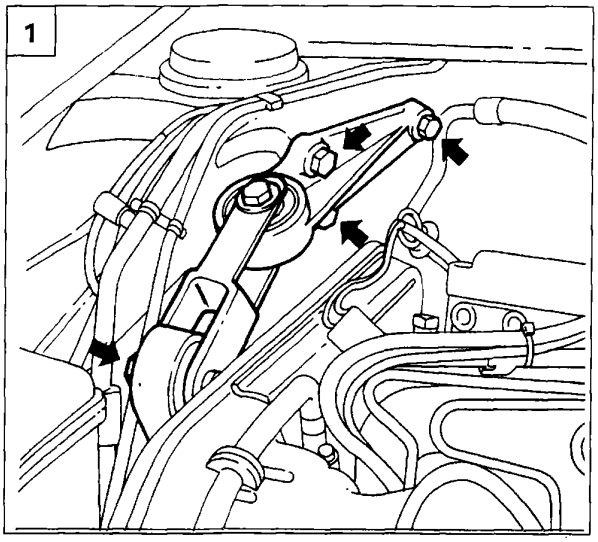



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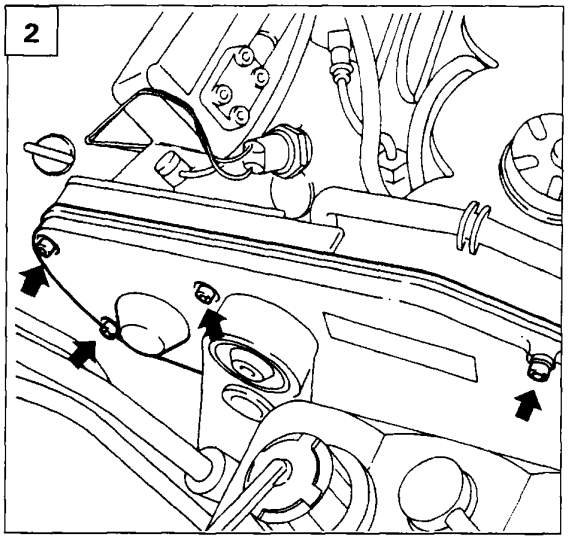


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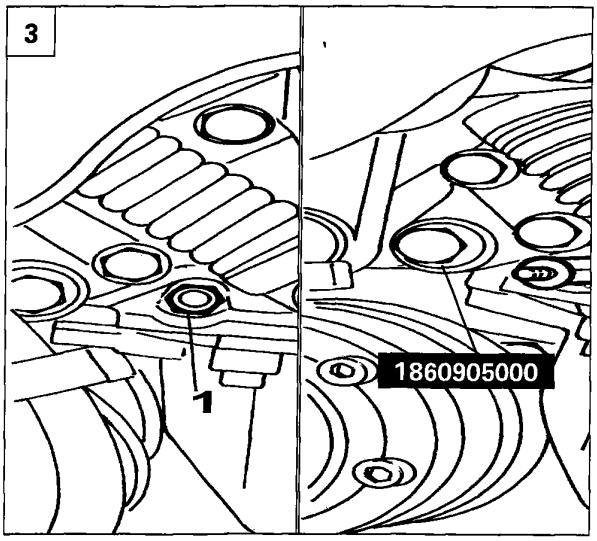
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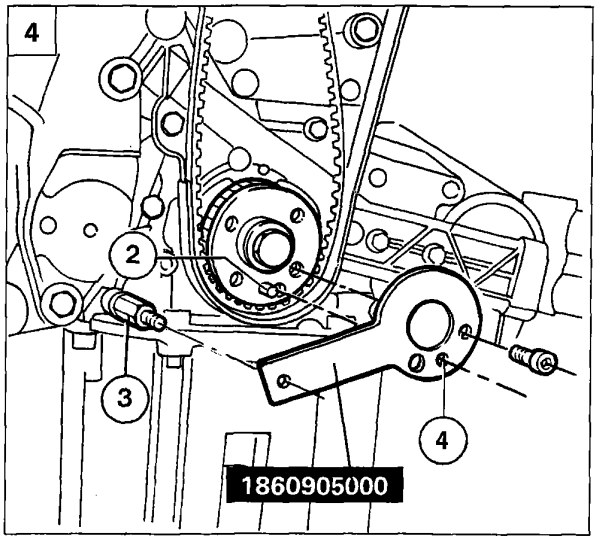



P4F40MJ02




P4F40MJ03

P4F40MJ04

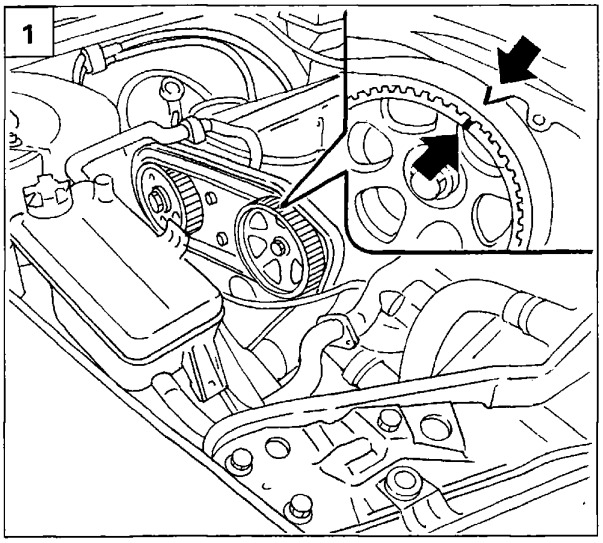



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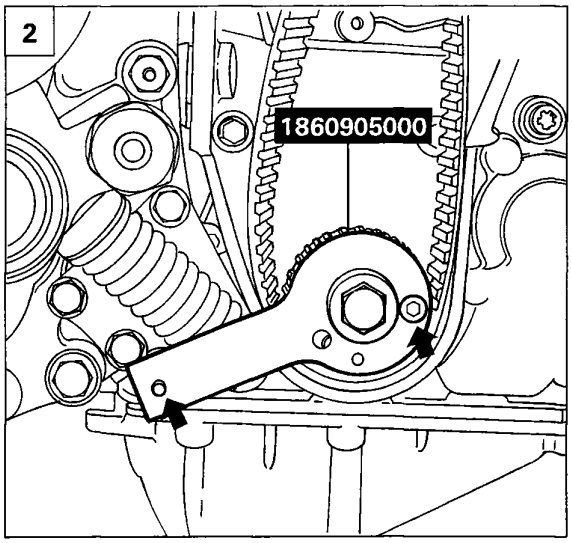
1. Remove the reaction rod and support, acting on the fixings shown in the diagram, in order to allow the subsequent removal of the upper timing belt shield.
2. Remove the upper timing belt shield.
3. Remove the oil pump fixing bolt; in place of the bolt, position the pin for tool 1860905000 for determining T.D.C.
4. Position tool 1860905000 on the crankshaft drive gear and on the pin (3) fitted previously; rotate the crankshaft using small movements until the centering dowel (2) matches with the opening (4) in the tool. In this position cylinder no. 1 is exactly aligned at T.D.C.



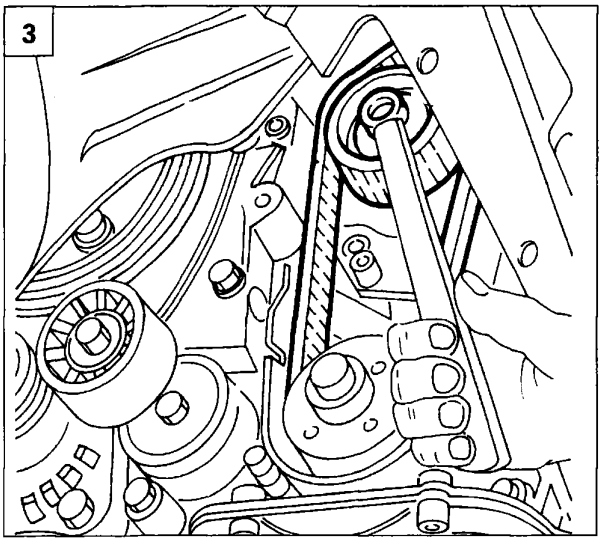
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P4F41MJ01

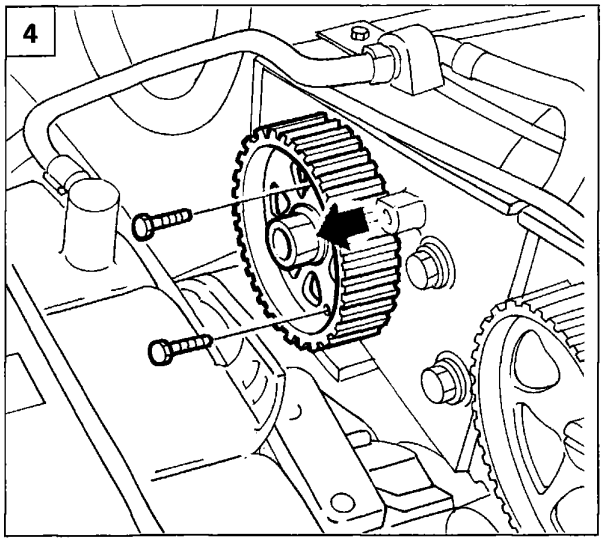



P4F41MJ02

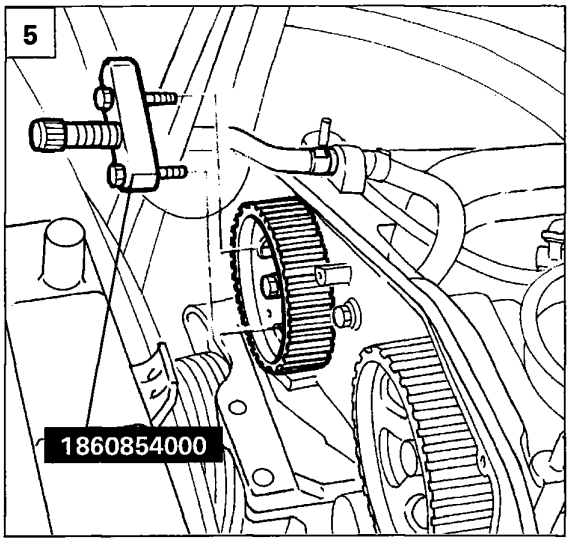



P4F41MJ03

1. Check that the reference on the timing toothed pulley is aligned with the reference mark for the timing of cylinder no. 1 at T.D.C.
2. Fix tool 1860905000 to the crankshaft drive gear using the bolt shown.
3. Loosen the timing drive belt moving tensioner nut and remove the timing belt."
4. Tighten the two adjustment screws in the special housings to lock the pressure pump drive pulley and undo the fixing nut.
5. Using tool 1860854000 shown in the diagram to remove the pulley.




P4F41MJ04

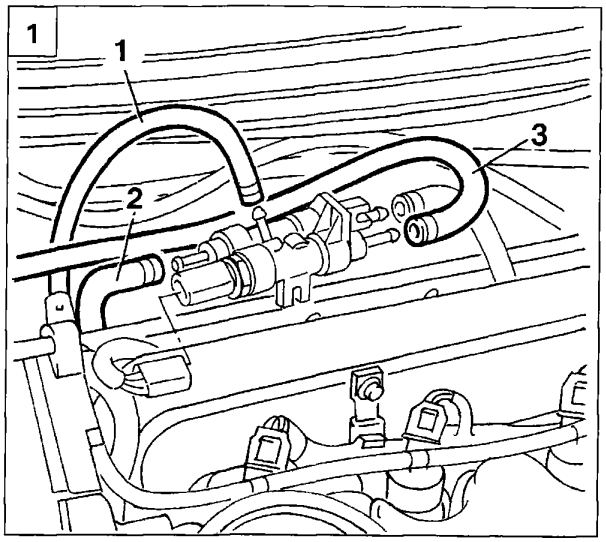



P4F41MJ05

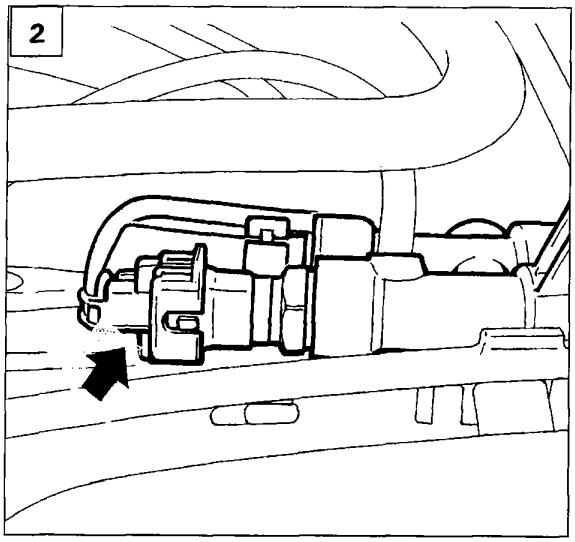


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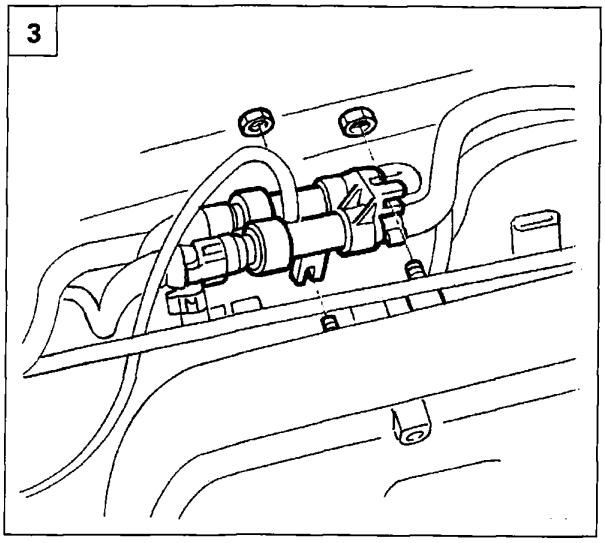
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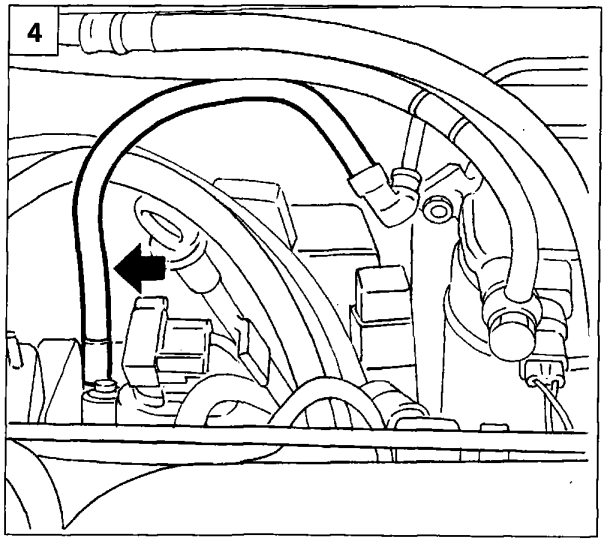

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P4F32MJ01




P4F28MJ04

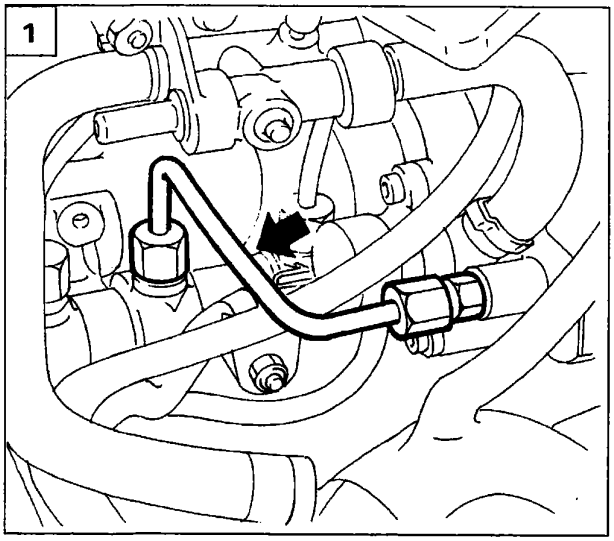



P4F42MJ02

1. Disconnect the following from the return manifold: the fuel return pipe from the injectors (1), the fuel return pipe from the pressure pump (2) and the fuel return pipe from the filter (3).
2. Disconnect the electrical connection from the fuel temperature sensor.
3. Acting on the fixing nuts, move the return manifold aside.
4. Loosen the fixing band and disconnect the fuel inlet pipe.

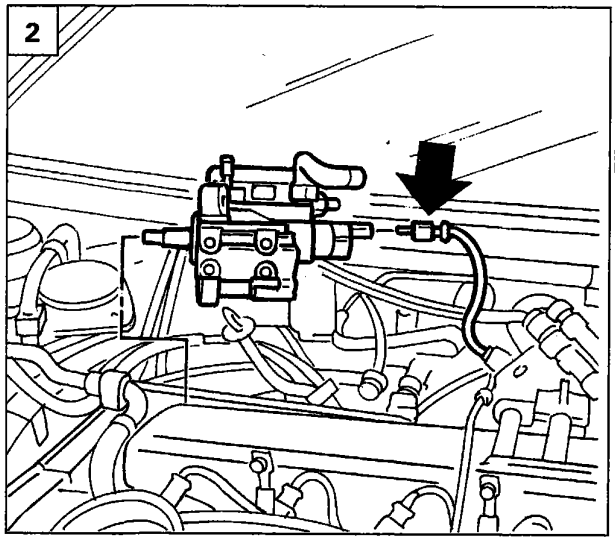


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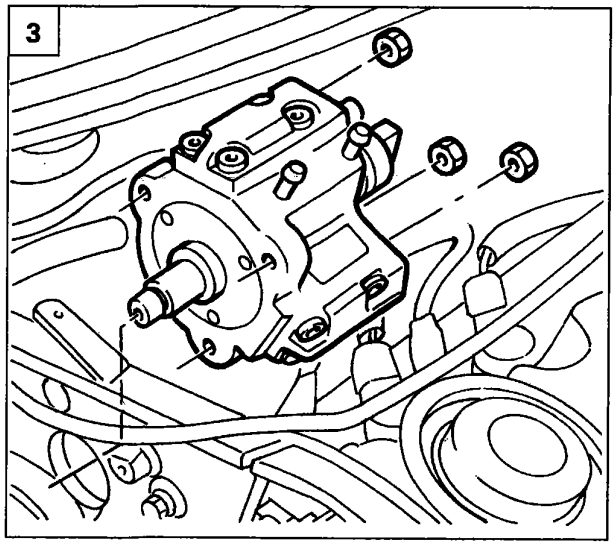

P4F34MJ01

1. Remove the fuel delivery pipe from the pressure pump to the rail pipe.




P4F43MJ02

2. Disconnect the electrical connection from the pressure regulator on the pressure pump



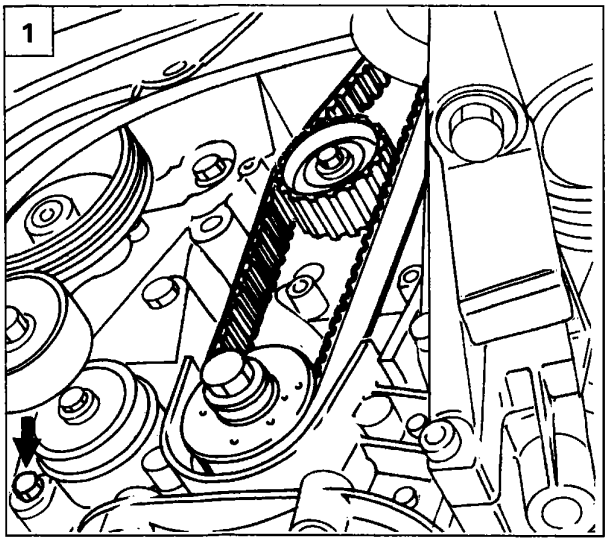

P4F43MJ03

3. Undo the retaining nuts and remove the pressure pump.

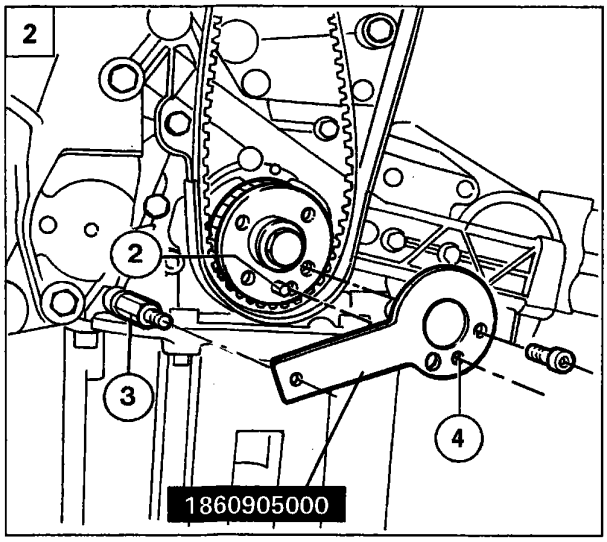


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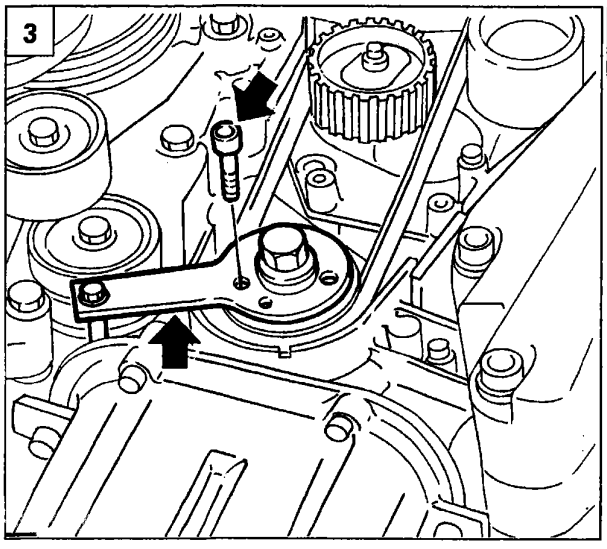
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P4F44MJ01




P4F44MJ02




P4F44MJ03

## Refitting

Reverse procedure described for removal to the point where the pressure pump is refitted. Then refit and tension the timing belt and auxiliary drivebelt.

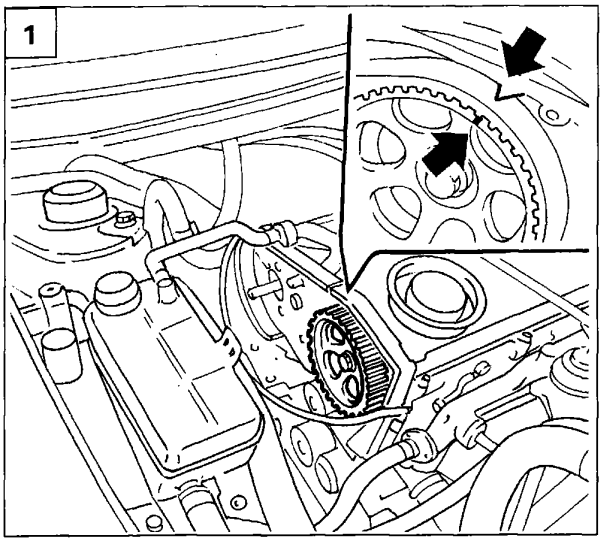
**NOTE** *The pipe leading from the pressure pump to the rail must be replace whenever it is disassembled and both pump side and manifold side fittings must be tightened to a torque of 2.2 daNm.*

## Fitting and tensioning timing drive belt

1. Fit the timing belt to the crankshaft gear provisionally and remove the bolt indicated from the oil pump.
2. Position tool 1860905000 on crankshaft drive gear and pin (3); turn the crankshaft through small movements until locating dowel (2) fits into hole (4) on the tool. In this position, cylinder no. 1 is exactly aligned with TDC.
3. Secure the tool to the crankshaft drive gear using the bolt shown.



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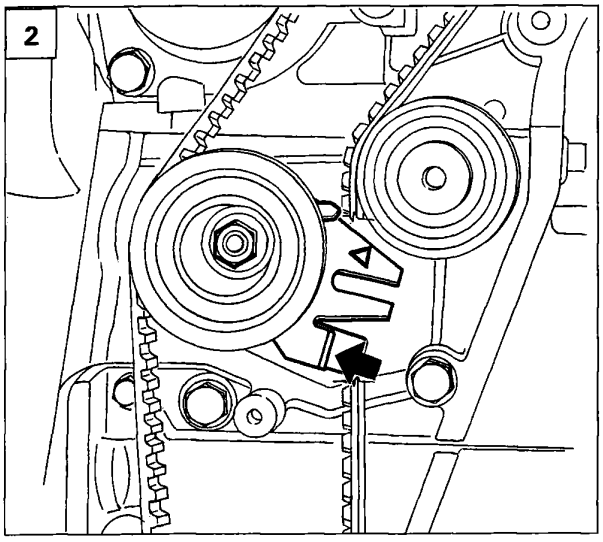



P4F45MJ01

Lower the lift.

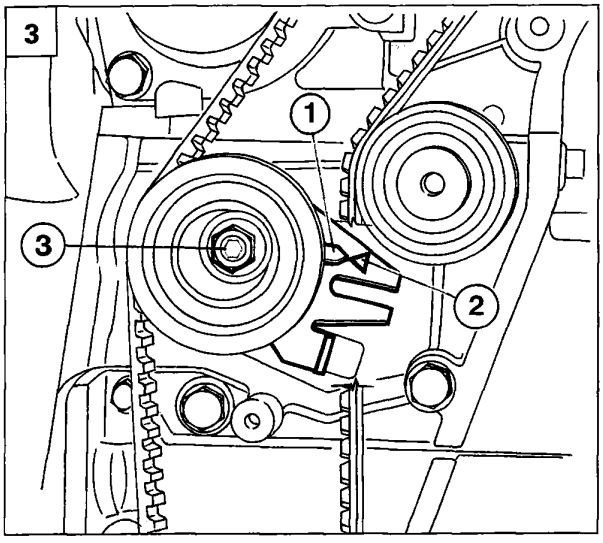
1. Rotate the driven pulley so that the timing references line up.

Raise the lift and complete the fitting of the timing belt, checking the timing.




P4F45MJ02

2. Using a screwdriver, apply force to the automatic tensioner so that it is in the maximum tension position, then tighten the nut fixing the tensioner to the support. Remove tool 1860905000 and rotate the engine through two revolutions in its normal direction of rotation.



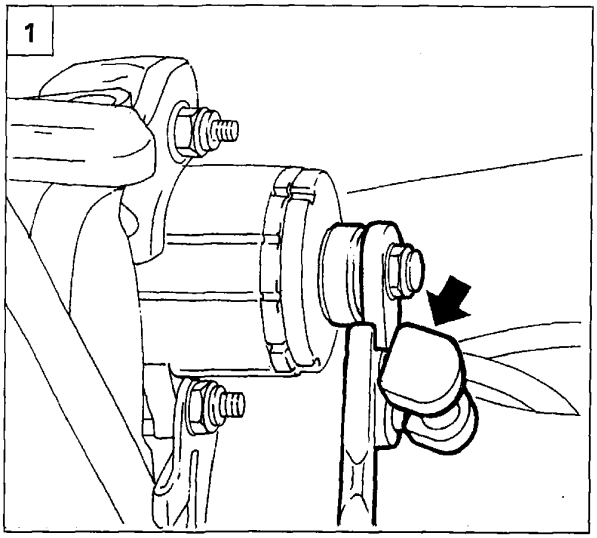

P4F45MJ03

3. Loosen the nut fixing the tensioner (3) and, using a screwdriver for leverage in order not to completely discharge the tension, make sure that the moving reference (1) on the tensioner coincides with the fixed reference (2), then tighten the nut fixing the tensioner (3) to the recommended torque.

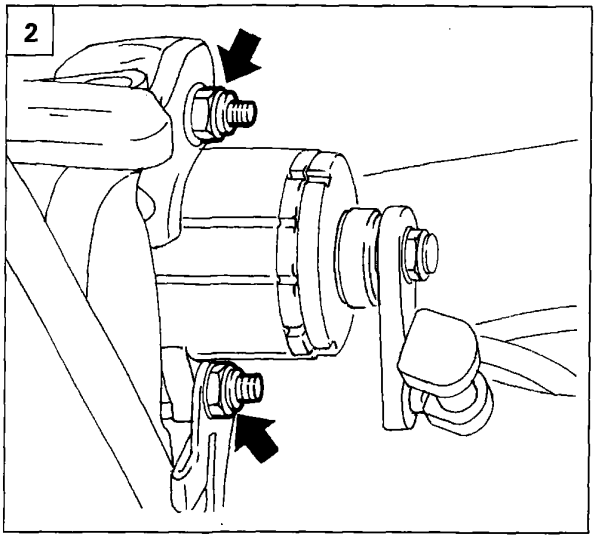


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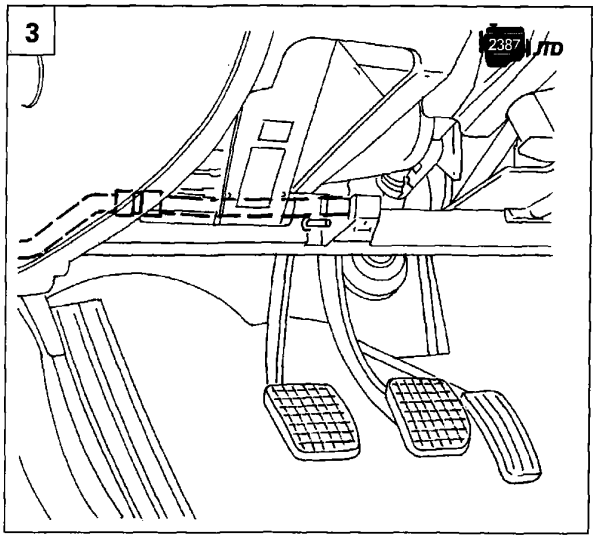
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P4F44MJ01




P4F44MJ02




P4F44MJ03

## REMOVING - REFITTING ACCELERATOR PEDAL POTENTIOMETER

- Disable the alarm (if fitted) via the switch under the junction unit cover and disconnect the negative battery terminal.
- Remove the shield under the pedals assembly.

1. Remove the potentiometer idler rod from the accelerator pedal.

1910 JTD

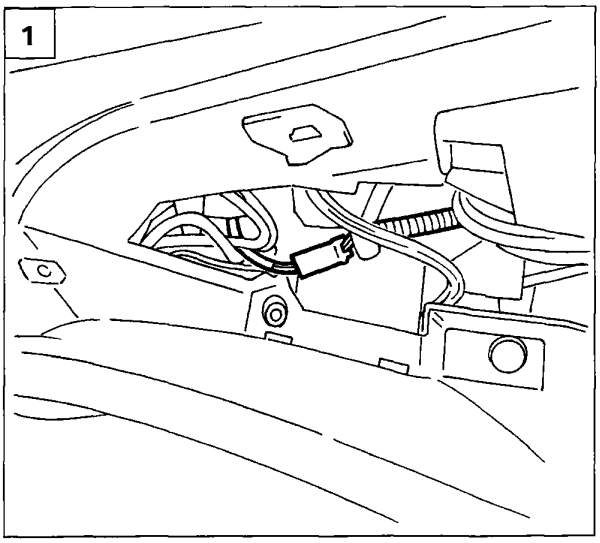
2. Undo the nuts fixing the potentiometer to the bracket for the steering column and remove the potentiometer.

   Move the wiring as close as possible to the plastic casing retining it, taking care not to damage the surrounding cables and remove the shield for the fuses from the glove compartment.

3. Disconnect the electrical connector for the potentiometer.



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P4F47MJ01

1. Disconnect the electrical connector for the potentiometer moving the wiring as close as possible to the plastic casing retaining it, taking care not to damage the surrounding cables.

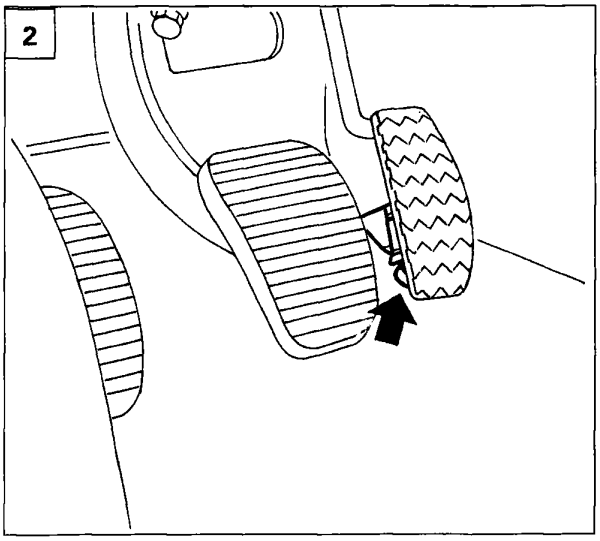
**REFITTING**

- Carry out the operations described above in the reverse order.

2387 JTD

- Positin the new potentiometer and restore the routing of the new bridge, fitting bands, as appropriate, under the tunnel so that the movement of the climate control components is not impeded and there is no noise/vibrations whilst the vehicle is moving.

2387 JTD

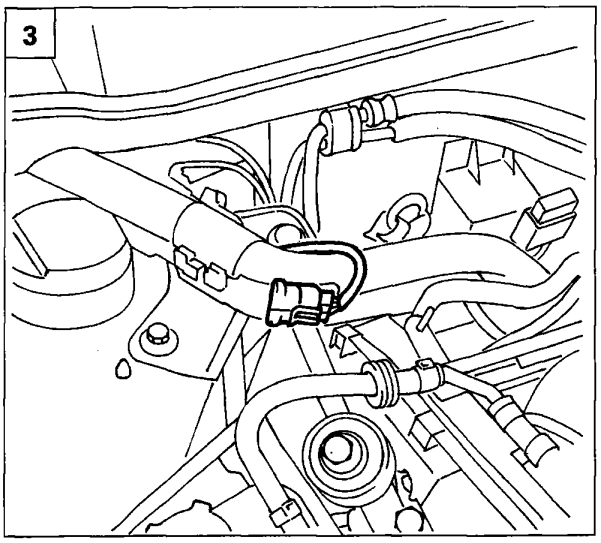



P4F47MJ03

**ADJUSTING ACCELERATOR PEDAL END OF TRAVEL**

2. Connect the diagnostic equipment to the socket in the engine compartment, right side, pillar area.

**With the pedal in the end of travel position, check that the voltage reading on the instrument is 3.8V ± 1V.**




P4F47MJ02

3. To correct the voltage values with the accelerator in the maximum position, regulate the adjustment device and repeat the procedure using the diagnostic equipment.



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- Timing sensor 12
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## FUEL SYSTEM

### INTRODUCTION

The Marea and Marea Weekend 1.9 JTD and 2.4 JTD vehicles are equipped with a 4 cylinder in line 1910 cc turbodiesel engine for the former and a 5 cylinder lin line 2387 cc turbodiesel engine for the latter, both with two valves per cylinder, a counter-balance shaft, an overhead camshaft, supercharged by a turbo-charger and intercooler and with electronic fuel injection.

The fuel system ensures the correct operation of the engine and can be summarized in the following circuits:

- fuel supply circuit with Common Rail type injection;
- air supply circuit;
- exhaust circuit;
- oil vapour recirculation circuit from the crankcase;
- exhaust gas recirculation circuit (EGR).

The optimum operation of the various "circuits" which make up the fuel system is achieved through an electronic control system managed by a specific control unit.
The main feature of the fuel system is the Common Rail type fuel injection. The Common Rail system involves electronic injection at high pressure for direct injection fast diesel engines.

The main features of the Common Rail system are:

- availability of high injection pressures (up to 1350 bar);
- possibility of modulating these pressures (from a minimum of 150 bar up to a maximum of 1350 bar) independently of the engine rotation speed and load.;
- capacity for operate at high engine speeds (up to 6000 rpm);
- precision injection control (advance and duration of injection);
- reduction in consumption;
- reduction in emissions.

### FUEL SYSTEM MANAGEMENT STRATEGIES

The control unit memory contains the management programme (software) which consists of a series of strategies, each of which manages a precise system control function.

By using the information supplied by the various sensors (input), each strategy processes a series of parameters, based on data maps stored in special areas of the control unit memory and then controls the system actuators (output) which are the devices which allow the engine to run.

The main aim of the management strategies is to determine the exact quantity of fuel which should be injected into the cylinders with the timing (injection advance) and pressure so that the engine behaviour is optimum in terms of power, consumption, fumes, emissions and driveability.

The main system management strategies are basically the following:

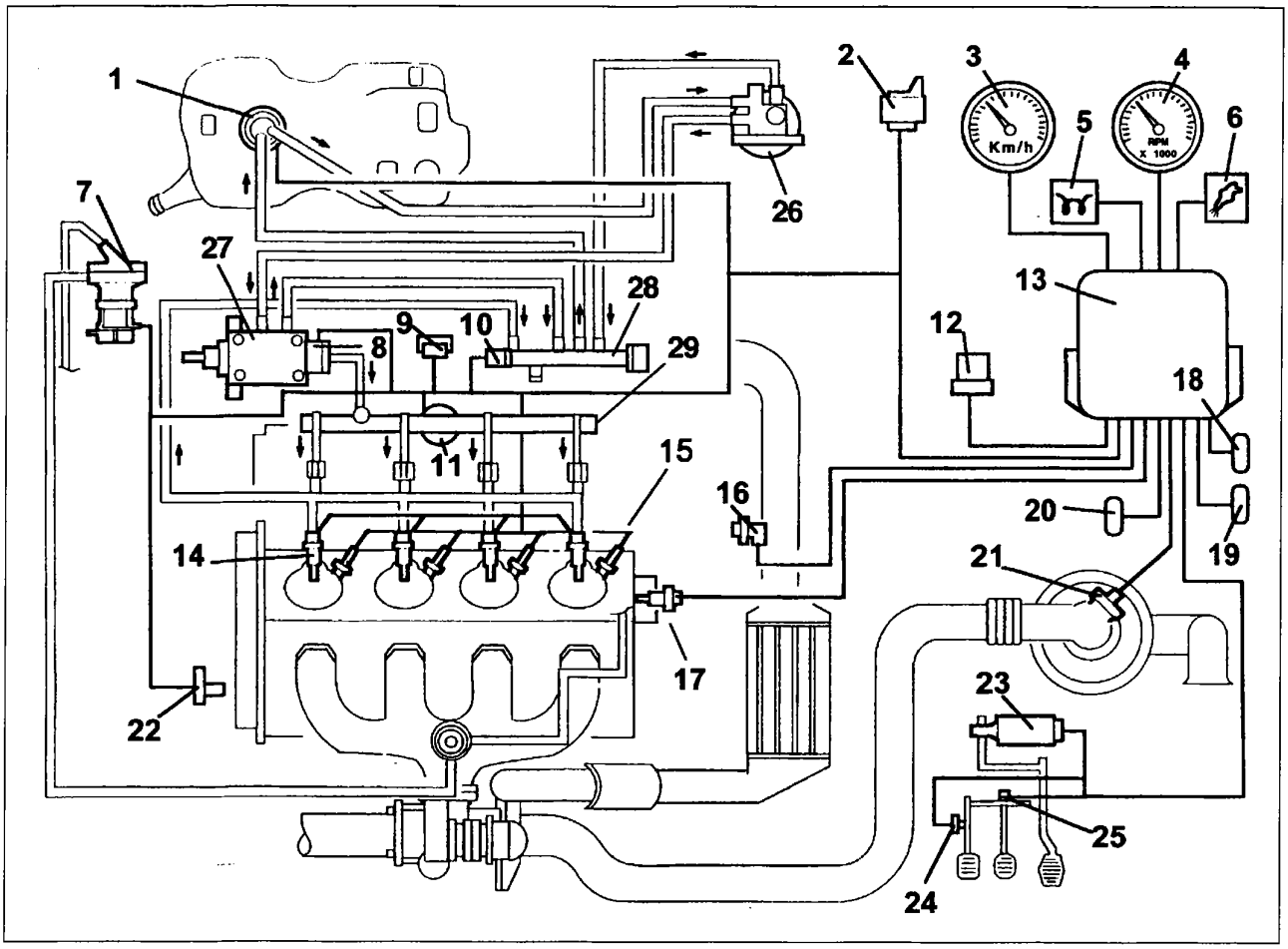
- controlling the quantity of fuel injected;
- controlling the injection advance;
- controlling the injection pressure;
- controlling the auxiliary electric fuel pump;
- controlling the injection during deceleration (cut-off);
- controlling the idle speed;
- controlling the restriction of the maximum speed;
- controlling the restriction of the maximum torque;
- controlling the fuel temperature;
- controlling the temperature of the engine coolant;
- controlling the heater plugs;
- controlling the exhaust fumes;
- controlling the exhaust gas recirculation (EGR);
- controlling the engagement of the climate control system;
- controlling the engine immobilizer function (Fiat CODE);
- autodiagnosis.

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# 10.

## FUEL SYSTEM FUNCTIONAL DIAGRAM




**NOTE** *The 1910 JTD (4 cylinder) engine is illustrated; the diagram for the 2387 JTD version only differs through the presence of the 5th cylinder.*

1. Auxiliary electric fuel pump
2. Heater plugs control unit
3. Vehicle speed
4. Rev counter
5. Heater plugs warning light
6. Infocenter (system failure warning)
7. EGR valve
8. Pressure regulator
9. Excess pressure sensor
10. Fuel temperature sensor
11. Fuel pressure sensor
12. Injection system relay
13. Electronic control unit
14. Injectors
15. Heater plugs
16. Rpm sensor
17. Engine coolant temperature sensor
18. Climate control system connector
19. Diagnostic socket
20. Fiat CODE system connector
21. Flow meter
22. Timing sensor
23. Potentiometer on accelerator pedal
24. Switch on clutch pedal
25. Switch on brake pedal
26. Fuel filter
27. Pressure pump
28. Return manifold (low pressure)
29. Supply manifold (high pressure)



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### Checking quantity of fuel injected

According to the signals coming from the accelerator pedal potentiometer, the flow meter and the rpm sensor, the control unit controls the fuel pressure regulator and the injectors.
The injection timing and phasing is determined by the starting of the engine using the signals coming from the rpm sensor and the timing sensor (synchronization phase); later, the injection timing is implemented using only the rpm signal and with the injection sequence 1-3-4-2 for the 1910 JTD version and 1-2-4-5-3 for the 2387 JTD version.

The control unit inhibits the injection in the following cases:

fuel pressure value above 1500 bar;
fuel pressure value below 120 bar;
engine speed above 6000 rpm.

At operating temperature the maximum duration of the injection (opening time of the injector) is 1500 ns, whilst during starting it can reach 3000 ns.

### Injection advance check

The electronic control unit determines the injection advance mainly on the basis of the quantity of fuel to be injected.
Later on, the injection advance is corrected according to the temperature of the engine coolant and engine speed in order to compensate, during the warm up stage, for the increase in the ignition delay due to the "low" temperatures in the combustion chambers.

### Injection pressure check

This check is particularly important because the injection pressure affects the following parameters:

the quantity of fuel introduced into the cylinders in relation to the duration of the injection;
the atomization of the fuel injected;
the penetration of the jet;
the delay betweenthe electrical operation of the injector and the effective start and end of the injection.

The above mentioned parameters have a considerable influence on the behaviour of the engine, especially as far as the power supplied, exhaust emissions, noise and driveability are concerned.
According to the engine load, the injection control unit operates the pressure regulator to always achieve an optimum line pressure.
With the engine cold, the injection pressure is corrected according to the engine speed and the temperature of the engine coolant in order to satisfy the engine requirements at different operating temperatures.

### Check on auxiliary electric fuel pump

The auxiliary electric fuel pump, immersed in the tank, is supplied by the injection control unit by means of a relay when the ignition key is in the ON position.
The supply to the electric pump is inhibited when one of the following conditions is verified:
-after the ignition has been switched ON for a certain time and the engine is not started up;
-if the inertia switch has been operated.

### Check on injection during deceleration (cut-off)

The fuel cut-off strategy is implemented when the injection control unit receives the information from the potentiometer that the accelerator pedal is released.
Under these circumstances the control unit cuts off the supply to the injectors and reactivates before the idle speed is reached.

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## Control of idle speed

According to the signals coming from the rpm sensor and the engine coolant temperature sensor, the injection control unit operates the pressure regulator and alters the operating times for the injectors to keep the idle speed constantly stable.
In certain conditions, the control unit also takes into account the battery voltage when controlling the idle speed.

## Maximum speed restriction control

According to the number of revs, the injection control unit limits the maximum speed through two types of intervention:

- as the maximum speed is approached, it decreases the quantity of fuel injected, reducing the line pressure;
- when 6000 rpm is exceeded it inhibits the operation fo the injectors.

## Maximum torque restriction control

According to the engine speed, the injection control unit calculuates the torque limit and maximum permissible fumes parameters using pre-defined maps in its memory.
It therefore corrects the above parameters with data on the engine coolant temperature and vehicle speed and uses the figures obtained in this way to meter the quantity of fuel to be injected acting on the pressure regulator and the injectors.

## Fuel temperature control

The injection control unit is constantly informed of the temperature of the fuel by the snsor on the return manifold.
If the temperature of the fuel exceeds a certain value (about 110 °C), the control unit reduces the line pressure acting on the pressure regulator and leaving the injection times unaltered.

## Engine coolant temperature control

The injection control unit is constantly informed of the temperature of the engine coolant by the sensor on the thermostat.
If the temperature of the engine coolant exceeds certain values, the control unit implements the following strategies:

- it reduces the quantity of fuel injected, acting on the pressure regulator and the injectors (power reduction);
- it operates the engine radiator cooling ran.

## Heater plugs control

The injection control unit controls the operation of the heater plugs control unit so that the temperature in the combustion chambers facilitates the self-ignition of the fuel and makes starting easier.
In effect, the injection control unit controls the operation of the heater plugs control unit for a given period of time both before (pre-heating) and after (post-heating) the engine is started and also controls the warning light in the instrument panel.
The pre-heating and post-heating times, plus how long the heater plugs warning light remains on, depend on the temperature of the engine coolant.



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### Exhaust fumes control

Through this function the control unit limits any exhaut fumes which could occur during fierce acceleration.
To satisfy this requirement, the control unit processes the signals from the accelerator pedal potentiometer, the rpm sensor and the intake air quantity sensor (flow meter) and operates the fuel pressure regulator and the injectors to meter the quantity of fuel to be injected.

### Exhaust gas recirculation control

According to the signals from the rpm sensors, the quantity of intake air, the temperature of the engine coolant and the position of the accelerator pedal, the injection control unit calculates the operating times for the EGR solenoid valve so that the exhaust gases are only partly recirculated in certain engine operating conditions.

### Air conditioning system engagement control

The injection control unit manages the operation of the air conditioning system compressor electromagnet coupling following a logic aimed at avoiding operating conditions which would adversely affect engine performance.

When the compressor is switched on, the injection control unit increases the quantity of fuel at the idle speed to help the engine adjust to the greater power requirements and interrupts the supply to the compressor in the following conditions:

- high power requirements by the engine (fierce acceleration);
- excessive engine coolant temperature.

### Engine immobilizer function control

The system is equipped with an engine immobilizer function. This function is achieved thanks to the presence of a special control unit (Fiat CODE) capable of conversing with the injection control unit and an electronic key with a special transmitter for sending a recognition code.
Each time the key is turned to the OFF position, the Fiat CODE system completely deactivates the injection control unit.

When the key is turned to the ON position, the following operations take place in order:

1. the injection control unit (whose memory contains a secret code) sends the Fiat CODE control unit a request for the latter to send the secret code to deactivate the immobilizing function;
2. the Fiat CODE control unit responds by only sending the secret code after having, in turn, received the recognition code transmitted by the ignition key;
3. the recognition of the secret code allows the deactivation of the immobilizer function on the injection control unit and normal operation can be resumed.

### Autodiagnosis

The complete electronic fault diagnosis of the injection system can be achieved by connecting the special equipment (EXAMINER or SDC) to the diagnostic socket.

The system is also equipped with an autodiagnostic function which recognizes, memorizes and signals any possible failure.

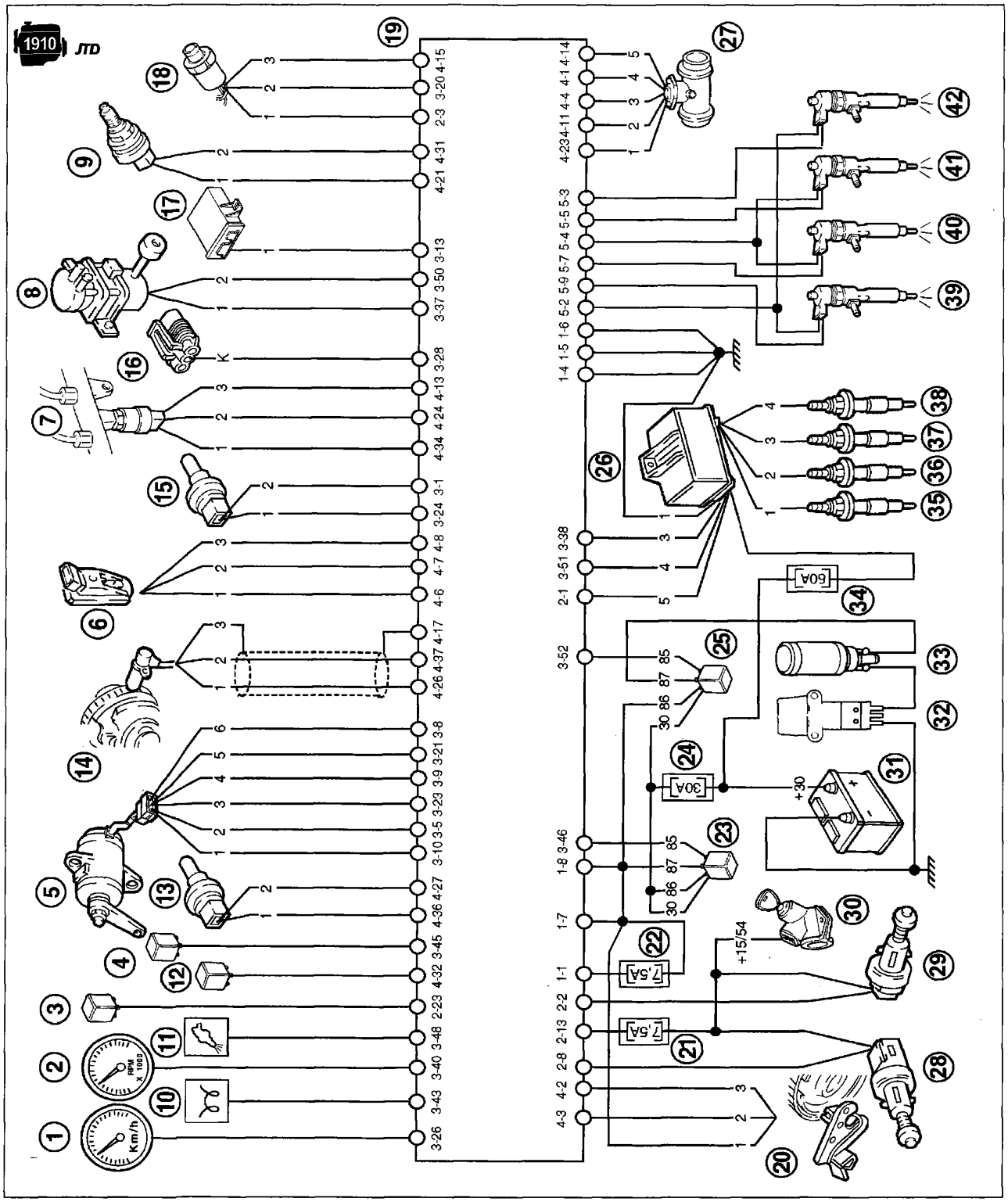
If a fault is detected in the sensors or actuators, the signal reconstruction strategies are immediately activated (recovery) so that the operation of the engine at an acceptable level is guaranteed without adversely affecting the operation. \311 it is possible to drive the vehicle to a service centre for appropritate repairs.

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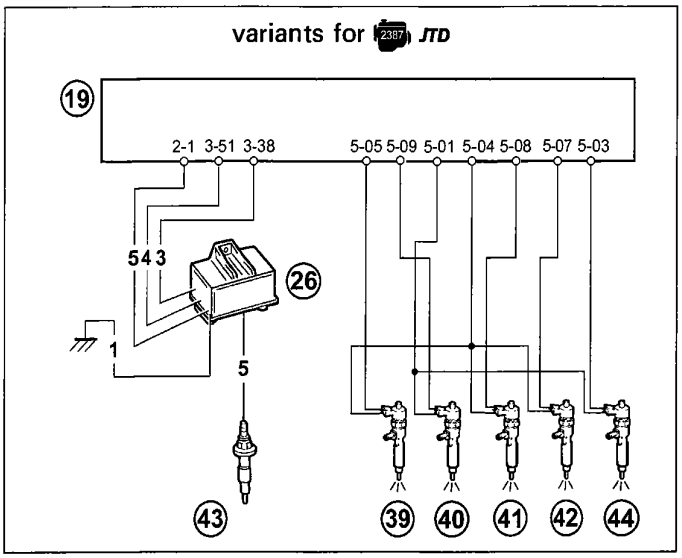
## INJECTION SYSTEM WIRING DIAGRAM






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## Injection system wiring diagram components




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1. Vehicle speed
2. Rev counter
3. Engine radiator fan low speed relay feed
4. Engine radiator fan high speed relay feed
5. Accelerator pedal potentiometer
6. Timing sensor
7. Fuel pressure sensor
8. EGR solenoid valve
9. Fuel pressure regulator
10. Heater plugs warning light in instrument panel
11. Injection system failure warning light
12. Air conditioning system relay feed
13. Engine coolant temperature sensor
14. Rpm sensor
15. Fuel temperature sensor
16. Diagnostic socket
17. Fiat CODE control unit
18. Four stage pressure switch
19. Injection electronic control unit
20. Excess pressure sensor
21. Injection system protective fuse (7.5A) (+15 supply from ignition switch)
22. Injection control unit protective fuse (7.5A) (+30 supply from battery)
23. Injection system main relay
24. Injection system protective fuse (30A)
25. Auxiliary electric fuel pump relay feed
26. Heater plugs control unit
27. Intake air temperature and quantity sensor (flow meter)
28. Switch on brake pedal
29. Switch on clutch pedal
30. Ignition switch
31. Battery
32. Inertia switch
33. Auxiliary electric pump (immersed in tank)
34. Heater plugs control unit protective fuse (60A)
35. Heater plug for cylinder no.1
36. Heater plug for cylinder no.2
37. Heater plug for cylinder no. 3
38. Heater plug for cylinder no. 4
39. Injector for cylinder no. 1
40. Injector for cylinder no. 2
41. Injector for cylinder no. 3
42. Injector for cylinder no. 4
43. Heater plug for cylinder no. 5 (2387 JTD only)
44. Injector for cylinder no. 5 (2387 JTD only)

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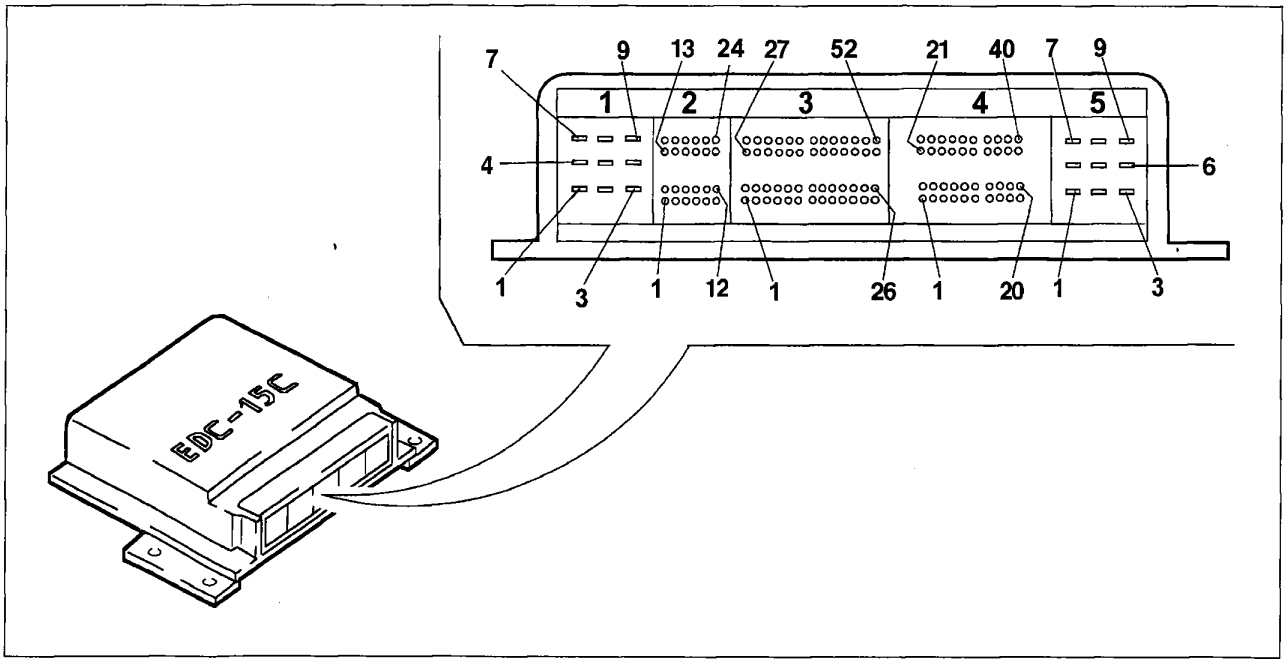

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# 10.

## INJECTION ELECTRONIC CONTROL UNIT

The injection electronic control unit processes the signals coming from the various sensors through the application of software algorhythms and controls the operation of the actuators (in particular the injectors and pressure regulator) to ensure the best possible operation of the engine.
The control unit is the flash E.P.R.O.M. type which can be reprogrammed from the outside without adjusting the hardware.
The injection control unit includes an absolute pressure sensor and is connected to the wiring by means of a 134 pin connector.

### Identification of injection control unit connections (pin-out)

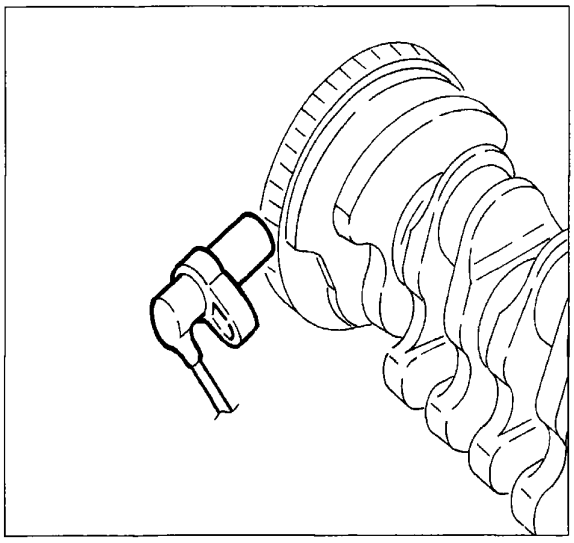



4F008NJ01

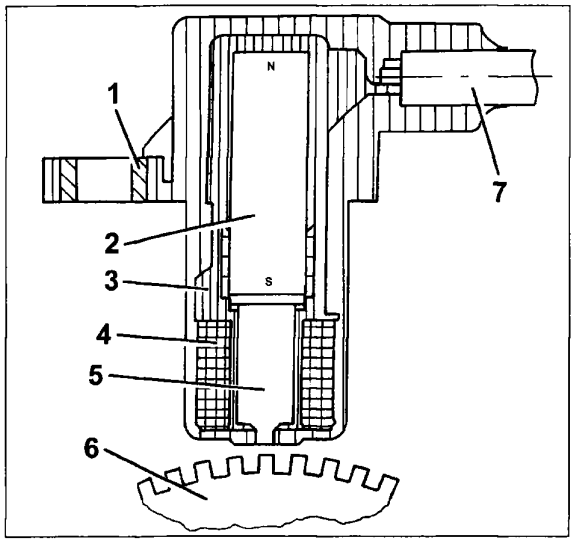
1-01 Battery positive (+30) from main relay
1-02 Not connected
1-03 Not connected
1-04 Earth
1-05 Earth
1-06 Earth
1-07 Battery positive (+30) from main relay
1-08 Battery positive (+30) from main relay
1-09 Not connected
2-01 Heater plugs timer signal
2-02 Switch on clutch pedal
2-03 Climate control engagement request
2-04 Not connected
2-05 Not connected
2-06 Not connected
2-07 Not connected
2-08 Switch on brake pedal
2-09 Not connected
2-10 Not connected
2-11 Not connected
2-12 Not connected
2-13 Positive (+15) from ignition switch
2-14 Not connected
2-15 Not connected
2-16 Not connected
2-17 Not connected
2-18 Not connected
2-19 Not connected
2-20 Not connected
2-21 Not connected
2-22 Not connected
2-23 Engine radiator fan low speed engagement request
2-24 Not connected
3-01 Fuel temperature sensor earth
3-02 Not connected
3-03 Not connected



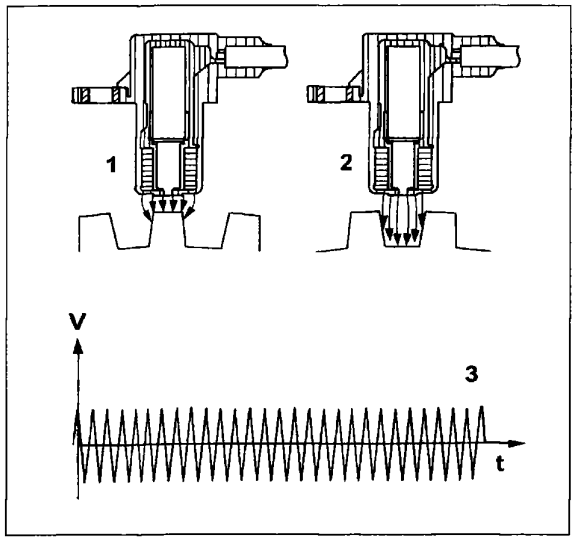
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4F011NJ01




4F011NJ02




4F011NJ03

## RPM SENSOR

The rpm sensor is fitted on the cylinder block/crankcase and is facing the flywheel on the crankshaft.

The sensor is the inductive type, i.e. it operates through the variation in the magnetic field produced by the passing of the flywheel teeth (60-2 teeth) in front of the sensor element.

The injection control unit uses the rpm sensor signal to determine the angular position of the crankshaft and the speed.

### Operation

The passage from full to empty, due to whether or not there is a tooth, determines a variation in the magnetic flow sufficient to produce an alternating voltage from the counting of the teeth on the flywheel.

The peak output voltage value from the rpm sensor depends, all things being equal, on the distance between the sensor and the flywheel teeth.

1. Metal bushing
2. Permanent magnet
3. Sensor casing
4. Winding
5. Core
6. Flywheel
7. Electrical connection

To obtain correct signals, the distance between the flywheel and the sensor (gap) should be between 0.8 and 1.5 mm.
This distance cannot be adjusted therefore if the gap measured is outside of the tolerance, check the condition of the sensor and the flywheel.

**Winding resistance: 860 Ohm ±110% at 20 °C**

1. Maximum magnetic flow
2. Minimum mangetic flow
3. Alternating voltage



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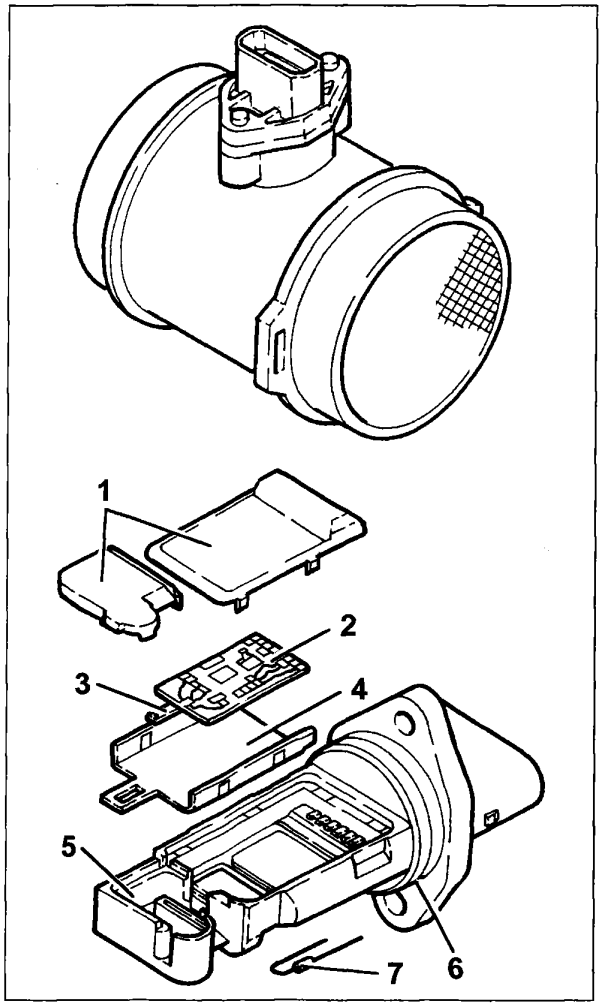
# 10.

## TIMING SENSOR

This sensor is the Hall effect type and is fitted on the cylinder head facing the camshaft pulley (exhaust).
There is an opening in the pulley which allows the timing sensor to detect and signal the engine timing position to the injection control unit.
The injection control unit uses the timing senor signal to recognize TDC at the end of the compression stroke.

### Operation

A semi-conductor layer, through which current flows, immersed in a normal magnetic field (lines of force perpendicular to the direction of the current) produces a difference in power known as Hall voltage.
If the intensity of the current remains constant, the voltage produced only depends on the intensity of the magnetic field; the intensity of the magnetic field simply needs to vary periodically to produce a modulated electrical signal whose frequency is proportional to the speed at which the magnetic field changes.
To obtain this change, the sensor passes through a metal ring (inner part of the pulley) with an opening.
As the metal part of the ring moves it covers the sensor blocking the magnetic field with a consequent low output signal; conversely, corresponding to the opening and the presence of the magnetic field, the sensor produces a high signal.
This signal, together with the rpm and TDC signals, allow the injection control unit to recognize the position of the pistons and determine the injection point.




4F012NJ01

## AIR FLOW METER

The flow meter is on the air inlet hose and is the heated film type.
The intake air temperature sensor is inside the flow meter.

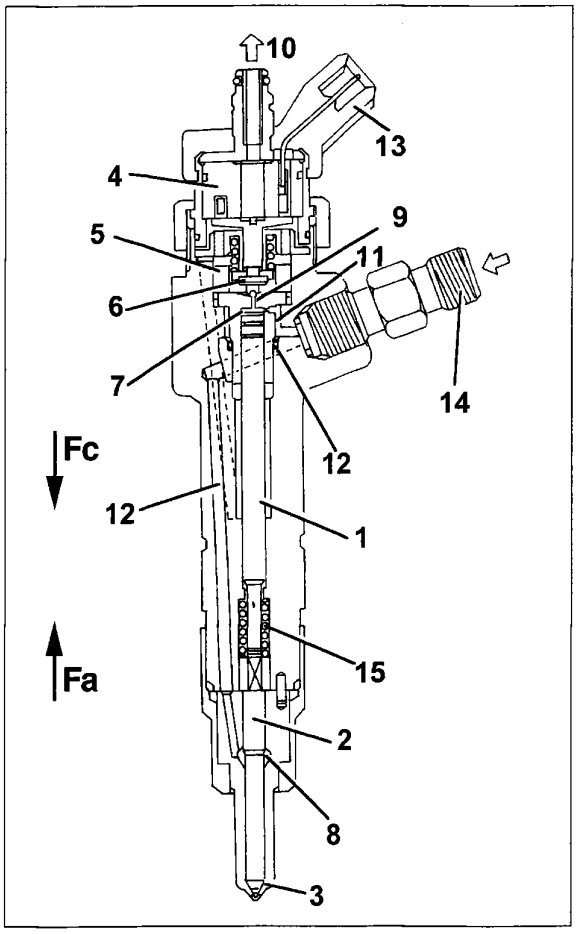
### Operation

The operating principle is based on a heater diaphragm in a measuring duct through which the intake air entering the engine flows.
The hot film diaphragm is kept at a constant temperature (about 120 °C above the temperature of the intake air) by the heating resistance.
The mass of air passing through the measuring duct tends to remove heat from the diaphragm therefore, in order to keep the latter at a constant temperature, a certain current must pass through the resistance.
This current, being proportional to the mass of air flowing to the engine, is measured by a suitable Wheatstone bridge and the signal is sent to the injection control unit.

1. Covers
2. Electronic card
3. Sensor
4. Support plate
5. Support
6. Seal (O-Ring)
7. Temperature sensor



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4F013NJ01

1. Pressure rod
2. Pin
3. Jet
4. Coil
5. Valve
6. Ball shutter
7. Control area
8. Supply volume
9. Control volume
10. Fuel outlet connector (low pressure)
11. Control duct
12. Supply duct
13. Electrical connection
14. Fuel inlet connector (high pressure)
15. Spring

## INJECTORS

The injectors, fitted on the cylinder head, are the electro-magnetic type operated directly by the injection control unit.
The injector have a high pressure supply duct and a recirculation pipe at ambient pressure; the supply duct is connected to the supply manifold (rail) with pipes designed to withstand high operating pressures.

The injector can be divided into two sections:

- actuator/nozzle consisting of a pressure rod (1), pin (2) and jet (3);
- solenoid valve consisting of a coil (4) and valve (5).

### Operation

The operation of the injector can be divided into three stages:

*1. rest position*

The coil (4) is de-energized and the shutter (6) is in the closed position and does not allow the introduction of fuel into the cylinder: Fc > Fa where Fc is the force produced by the pressure acting on the control area (7) of the pressure rod (1) and Fa is the force due to the pressure acting in the supply volume (8).

*2. start of injection*

The coil (4) is energized and causes the lifting of the shutter (6). The fuel flows from the control volume (9) to the return manifold causing a decrease in pressure at the control area (7). At the same time, the line pressure passes through the supply duct (12) exerting a force in the supply volume (8) Fa > Fc causing the lifting of the pin (2) with the consequent introduction of fuel into the cylinders.

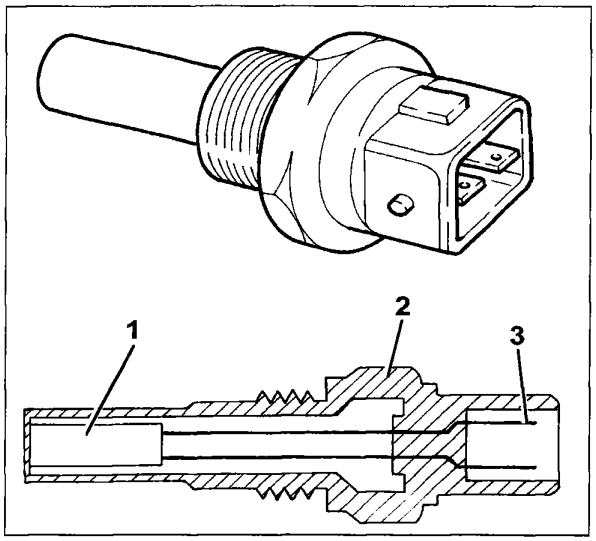
*3. end of injection*

The coil (4) is de-energized and returns the shutter (6) to the closed position recreating an equilibrium which returns the pin (2) to a closed position and consequently ends the injection.



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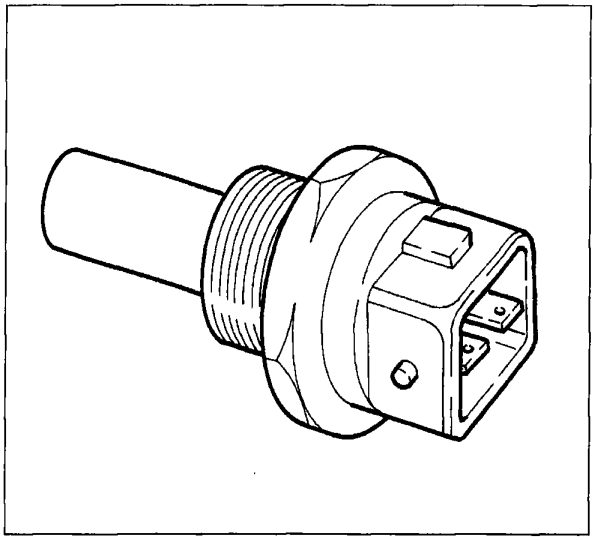



4F014NJ01

## ENGINE COOLANT TEMPERATURE SENSOR

This sensor is fitted on the thermostat and measures the temperature of the engine coolant by means of an NTC thermistor with a negative resistance coefficient.
The sensor is produced using semiconductor technology, therefore if the temperature of the sensor element increases as the temperature of the coolant increases, the value of the resistance decreases.
As the resistance variation is not linear, a temperature increase is higher at lower temperatures than at higher ones.

1. NTC resistance
2. Sensor body
3. Electrical connector

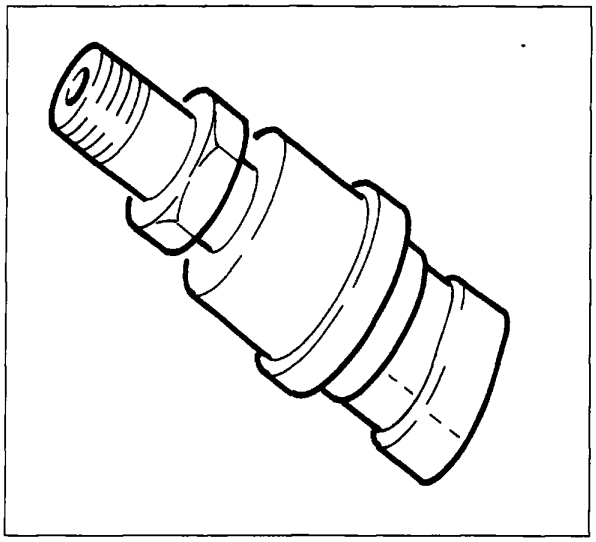


4F014NJ02

## FUEL TEMPERATURE SENSOR

This sensor is fitted on the return manifold and measures the temperature of the fuel by means of an NTC thermistor with a negative resistance coefficient.

For the operation of the sensor, refer to the previous description of the coolant temperature sensor.



4F014NJ03

## FUEL PRESSURE SENSOR

This sensor is fitted at the centre of the fuel supply manifold (rail) and has the task of providing the injection control unit with a feedback signal for:

- regulating the injection pressure;

- regulating the duration of the injection.



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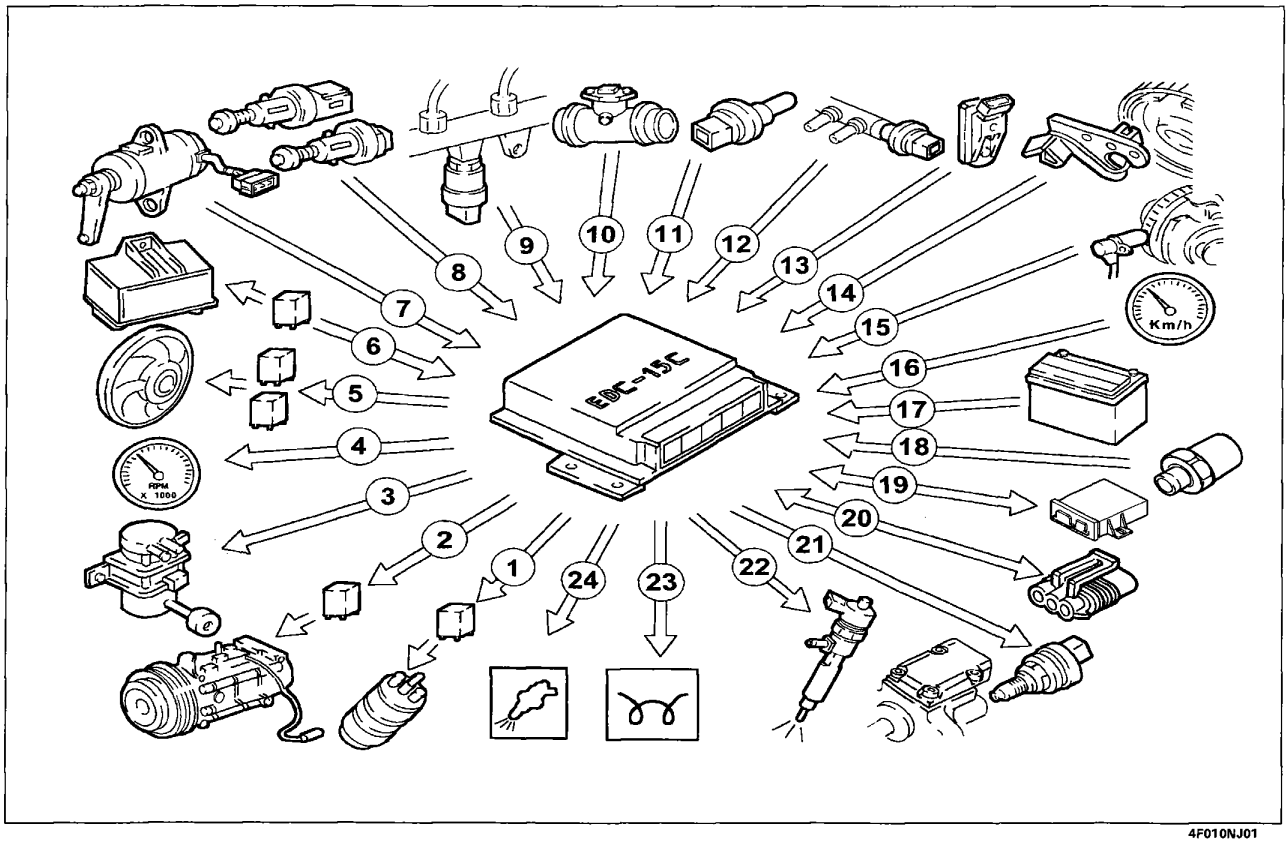
3-04 Not connected
3-05 Accelerator pedal potentiometer 1 supply
3-06 Not connected
3-07 Not connected
3-08 Accelerator pedal potentiometer 2 earth
3-09 Accelerator pedal potentiometer 2 signal
3-10 Accelerator pedal potentiometer 1 signal
3-11 Not connected
3-12 Not connected
3-13 Fiat CODE control unit
3-14 Not connected
3-15 Not connected
3-16 Not connected
3-17 Not connected
3-18 Not connected
3-19 Not connected
3-20 Climate control engagement go ahead from four stage pressure switch
3-21 Accelerator pedal 2 potentiometer supply
3-22 Not connected
3-23 Accelerator pedal potentiometer 1 earth
3-24 Fuel temperature sensor signal
3-25 Not connected
3-26 Vehicle speed signal (from ABS)
3-27 Not connected
3-28 Diagnostic socket connection (line K)
3-29 Not connected
3-30 Auxiliary electric fuel pump supply (immersed in the tank)
3-31 Not connected
3-32 Not connected
3-33 Not connected
3-34 Not connected
3-35 Not connected
3-36 Not connected
3-37 EGR solenoid valve supply
3-38 Heater plugs timer operation
3-39 Not connected
3-40 Rpm signal to rev counter
3-41 Not connected
3-42 Not connected
3-43 Heater plugs warning light
3-44 Not connected
3-45 Request to engage engine radiator fan high speed
3-46 Main relay go ahead
3-47 Not connected
3-48 Injection system failure
3-49 Not connected
3-50 EGR soleniod valve earth
3-51 Heater plugs operation timer
3-52 Auxiliary electric fuel pump relay go ahead
4-01 Flow meter supply
4-02 Timing sensor earth
4-03 Timing sensor signal
4-04 Flow meter earth
4-05 Not connected
4-06 Excess pressure sensor signal
4-07 Excess pressure sensor earth
4-08 Excess pressure sensor supply
4-09 Not connected
4-10 Not connected
4-11 Flow meter supply
4-12 N.C.
4-13 Fuel pressure sensor supply
4-14 Flow meter signal
4-15 Four stage pressure switch
4-16 Not connected
4-17 Rpm sensor screening
4-18 Not connected
4-19 Not connected
4-20 Not connected
4-21 Fuel pressure regulator
4-22 Not connected
4-23 Air temperature sensor signal
4-24 Fuel pressure sensor signal
4-25 Not connected
4-26 Rpm sensor signal
4-27 Engine coolant temperature sensor earth
4-28 Not connected
4-29 Not connected
4-30 Not connected
4-31 Fuel pressure regulator
4-32 Climate control system relay
4-33 Not connected
4-34 Fuel pressure sensor earth
4-35 Not connected
4-36 Engine coolant temerature sensor signal
4-37 Rpm sensor earth
4-38 Not connected
4-39 Not connected
4-40 Not connected
5-01 (1910 JTD) N.C.
5-01 (2387 JTD) Injectors for cylinders 2 and 5 supply
5-02 (1910 JTD) Injectors for cylinders 1 and 4 supply
5-02 (2387 JTD) N.C.
5-03 (1910 JTD) Operation of injector for cylinder no. 4
5-03 (2387 JTD) Operation of injector for cylinder no. 5
5-04 (1910 JTD) Injectors for cylinders 2 and 3 supply
5-04 (2387 JTD) Injectors for cylinders 1, 3 and 4 supply
5-05 (1910 JTD) Operation of injector for cylinder no. 3
5-05 (2387 JTD) Operation of injector for cylinder no. 1
5-06 (1910 JTD) N.C.
5-06 (2387 JTD) N.C
5-07 (1910 JTD) Operation of injector for cylinder no. 2
5-07 (2387 JTD) Operation of injector for cylinder no. 4
5-08 (1910 JTD) N.C.
5-08 (2387 JTD) Operation of injector for cylinder no. 3
5-09 (1910 JTD) Operation of injector for cylinder no. 1
5-09 (2387 JTD) Operation of injector for cylinder no. 2

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# 10.

## DIAGRAM SHOWING INFORMATION ENTERING/LEAVING THE INJECTION CONTROL UNIT AND SENSORS/ACTUATORS

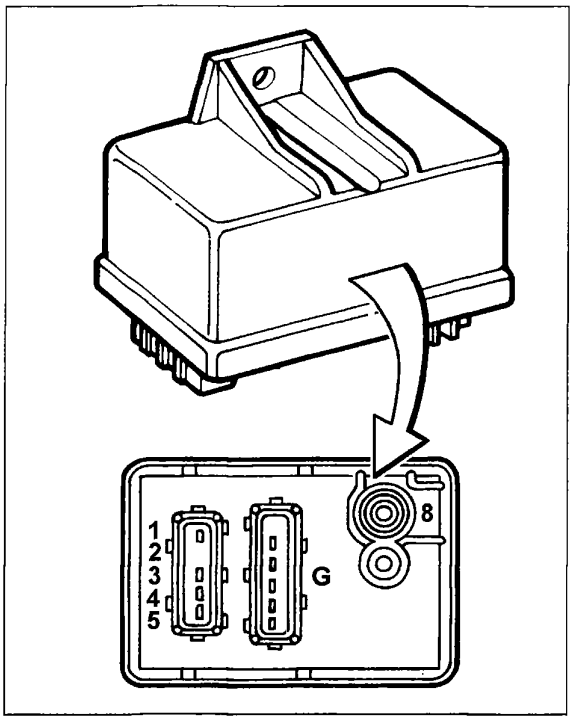



4F010NJ01

1. Auxiliary electric fuel pump
2. Climate control compressor
3. EGR solenoid valve
4. Rev counter
5. Engine radiator fan
6. Heater plugs control unit
7. Accelerator pedal potentiometer
8. Brake and clutch pedal switches
9. Fuel pressure sensor
10. Intake air temperature and quantity sensor (flow meter)
11. Engine coolant temperature sensor
12. Fuel temperature sensor
13. Excess pressure sensor
14. Timing sensor
15. Rpm sensor
16. Vehicle speed
17. Battery
18. Four stage pressure switch
19. Fiat CODE control unit
20. Diagnostic socket
21. Fuel pressure regulator
22. Injectors
23. Heater plugs warning light
24. Injection system failure



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4F015NJ01

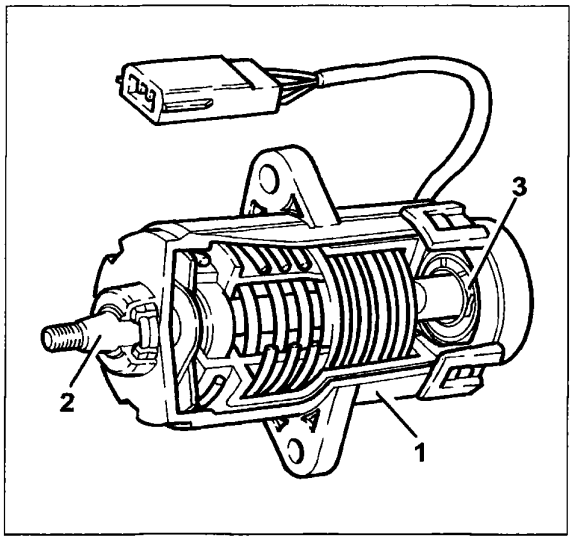
## HEATER PLUGS CONTROL UNIT

The operation of the heater plugs takes place via the heater plugs control unit under the direct control of the injection control unit.
There is an intelligent relay inside the heater plugs control unit which sends a feeback signal to the injection control unit which is therefore informed of any failure in the heater plugs control unit or a short circuit to earth for the heater plugs.

The diagram shows the connectors at the base of the heater plugs control unit and the pin out:

1. Earth
2. Connected to earth
3. Injection control unit (pins 3-38)
4. Injection control unit (pins 3-51)
5. Injection control unit (pins 2-1)
6. Battery positive (+30)

G. Heater plugs (only 4 outlets are used)




4F015NJ02

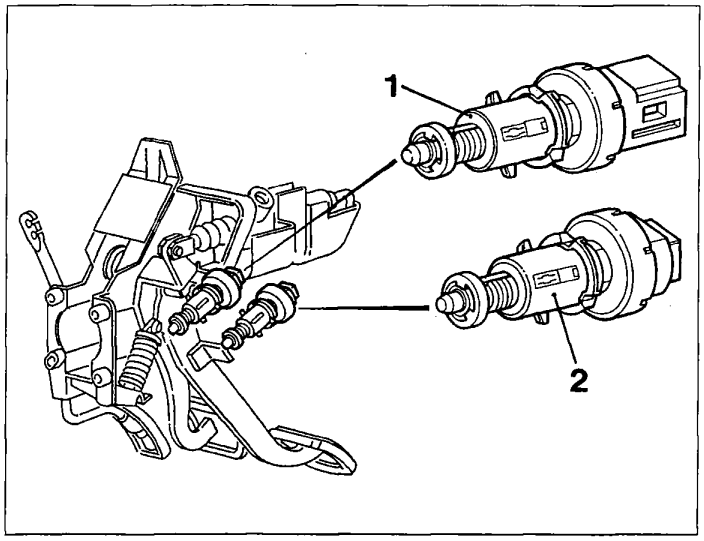
## ACCELERATOR PEDAL POTENTIOMETER

The position of the accelerator pedal is transformed into an electrical voltage signal and sent to the injection control unit by the potentiomter connected to the pedal.
The accelerator pedal position signal is processed together with information concerning the engine speed to obtain the injection time and pressure.
The sensor consists of a casing (1), fixed to the pedals assembly by a flange, which contains a shaft (2), in an axial position, connected to the two potentiometers (3): one main one and one safety one.
A coil spring on the shaft ensures the correct resistance to pressure, whilst a second spring ensures the return on release.



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# 10.




4F016NJ01

## BRAKE PEDAL SWITCH

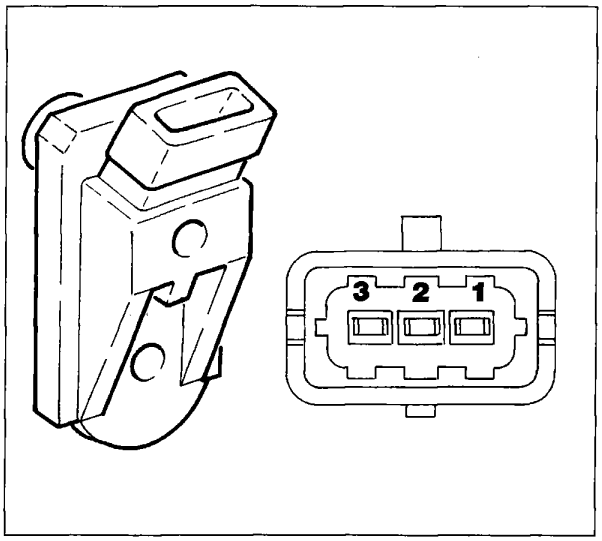
There is a switch (1) on the brake pedal which operates the brake lights; the same switch sends a signal to pins 2-8 of the injection control unit.

The "brake pedal pressed" signal is used by the control unit for:

- understanding that there is a deceleration situation;
- checking the plausibility of the signal coming from the accelerator potentiometer.

## CLUTCH PEDAL SWITCH

There is a switch (2) on the clutch pedal connected to pins 2-2 of the injection control unit.
The "clutch pedal operated" signal is used by the injection control unit to distinguish between gear engaged and gear change conditions.




4F016NJ02

## EXCESS PRESSURE SENSOR

This sensor is fitted on the inlet manifold and the signal transmitted to the injection control unit is used for:

- regulating the injection pressure;
- regulating the duration of the injection.

The diagram at the side illustrates the sensor and the electrical connector with the pin out:

1. Pressure signal
2. Earth
3. Supply

## ATMOSPHERIC PRESSURE SENSOR

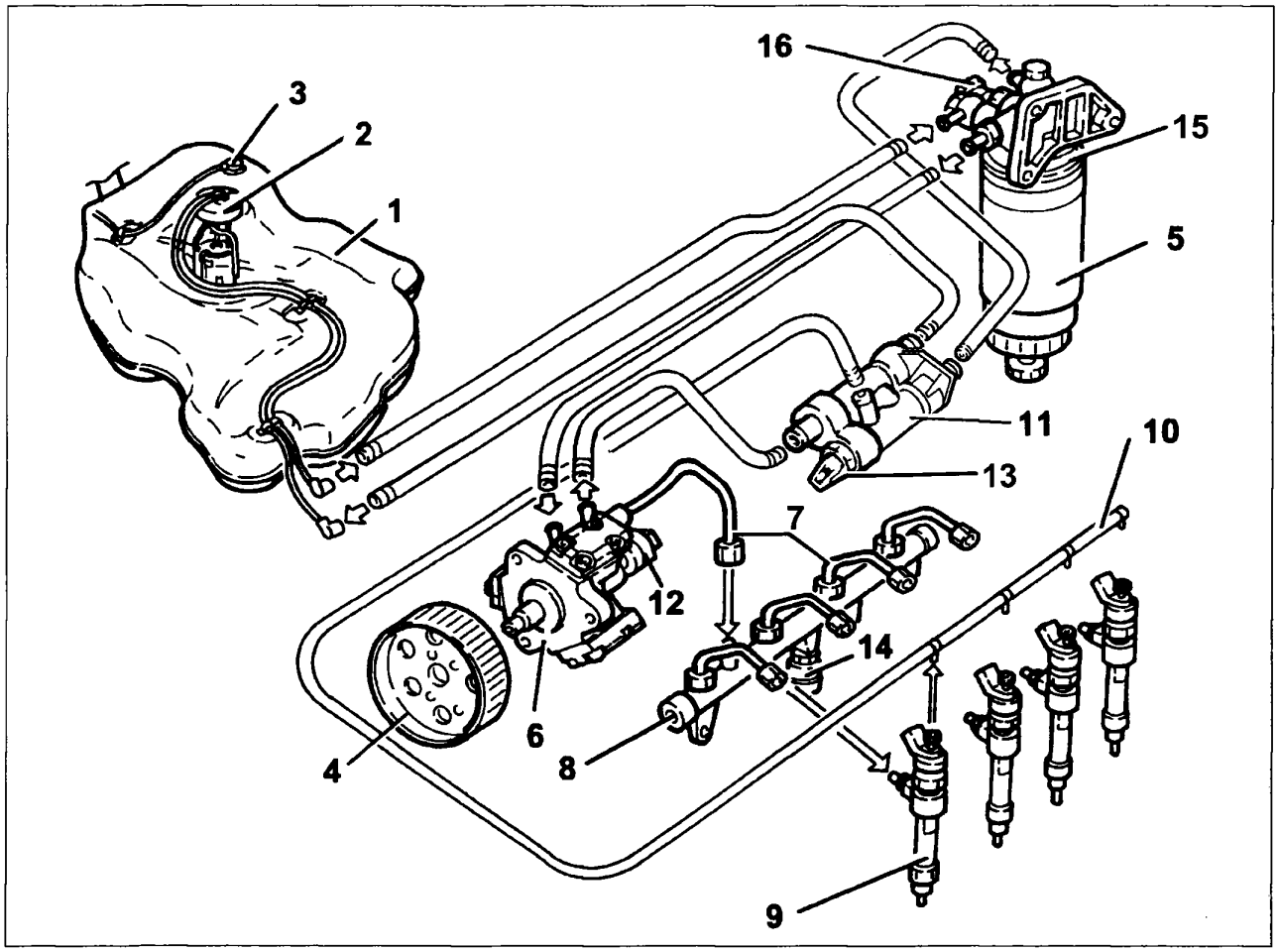
The atmospheric pressure sensor is contained inside the injection electronic control unit and has the task of measuring the atmospheric pressure in order to correct the air flow rate values measured and the reference values for controlling the EGR function.



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## FUEL SUPPLY CIRCUIT

The fuel supply circuit is divided functionally into the low pressure circuit and the high pressure circuit.
The low pressure circuit consists of a tank, multi-purpose valve, auxiliary electric pump immersed in the tank and return manifold.
The high pressure circuit consists of a radialjet pressure pump, supply manifold and injector.



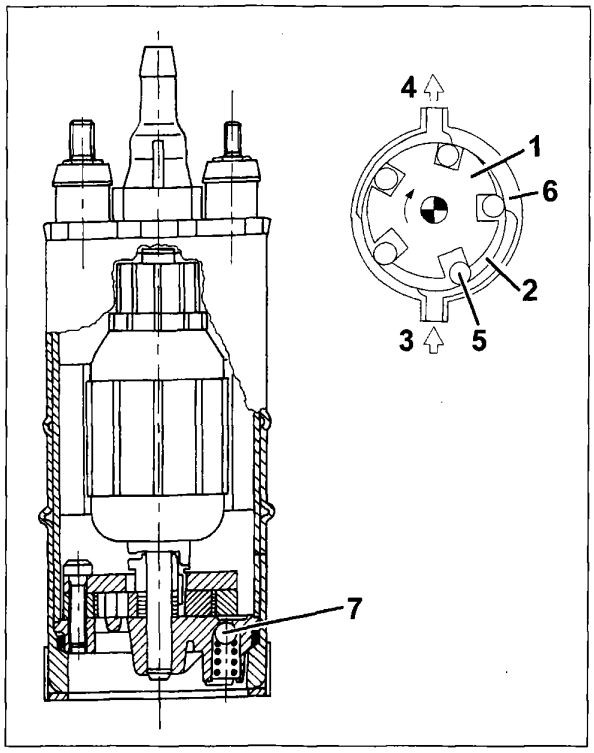

4F017NJ01

1. Fuel tank
2. Immersed (auxiliary) electric pump assembly complete with gauge
3. Multi-purpose valve
4. Pressure pump drive pulley
5. Diesel filter cartridge
6. Pressure pump
7. High pressure pipes
8. Supply manifold (rail)
9. Injectors
10. Fuel recirculation pipe (injectors return)
11. Return manifold
12. Pressure regulator
13. Fuel temperature sensor
14. Fuel pressure sensor
15. Diesel heater
16. Thermal switch

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# 10.




4F018NJ01

1. Impeller
2. Volumes
3. Inlet port
4. Supply port
5. Rollers
6. Outer seal
7. Excess pressure valve

## IMMERSED (AUXILIARY) ELECTRIC FUEL PUMP ASSEMBLY AND GAUGE

The assembly basically consists of:

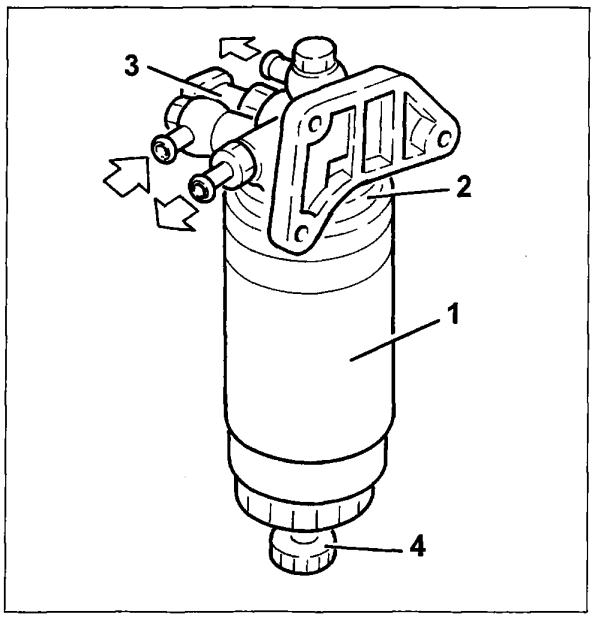
- a roller type electric pump;
- a fuel gauge;
- a fuel filter

The electric pump immersed in the fuel is the volumetric roller type with a motor with permanently energized magnets.

The impeller (1) rotates, driven by the electric motor, creating volumes (2) which move from the inlet port (3) to the supply port (4).

These volumes are defined by rollers (5) which adhere to the outer seal (6) during the rotation of the motor.

The electric pump has two valves: one single-acting valve to prevent the fuel circuit draining (when the pump is not working); the second excess pressure valve (7) which recirculates the supply with the inlet when pressures in excess of 5 bar are created.




4F018NJ02

## FUEL FILTER

The fuel filter is located in the engine compartment, fixed to the inlet manifold.

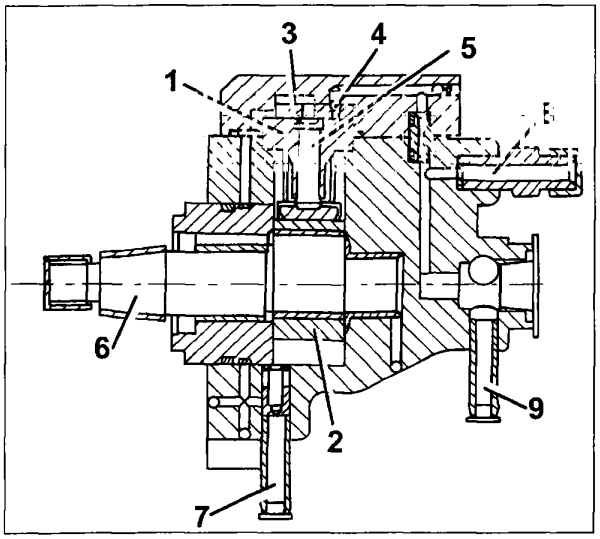
The filter is the cartridge type with a filter element (1) consisting of a pack of paper discs with a filtering surface of about 5300 cm 2 and a filtering degree of 4 - 5 mm.

The filter is equipped with a fuel pre-heating device (2) operated by a thermal switch (3) fitted on the actual filter.
When the temperature of the diesel is below 6 °C, an electrical resistance heats it up to a maximum of 15 °C before sending it to the pressure pump.
A plug (4) for draining the water is bolted to the base of the fuel filter cartridge.

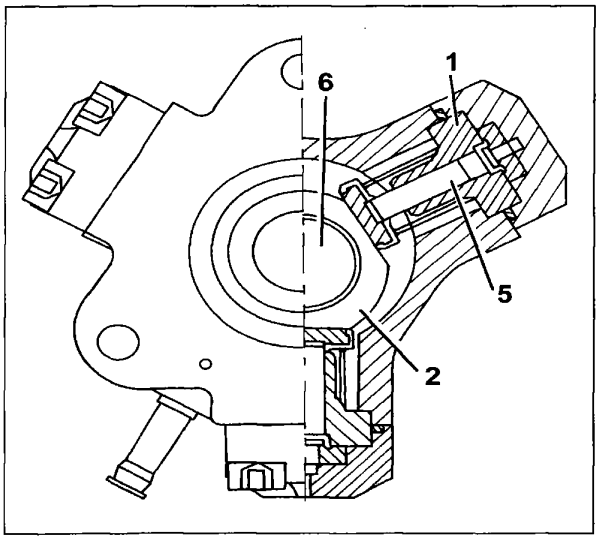
1. Filter cartridge
2. Diesel pre-heating device
3. Thermal switch
4. Water drain plug



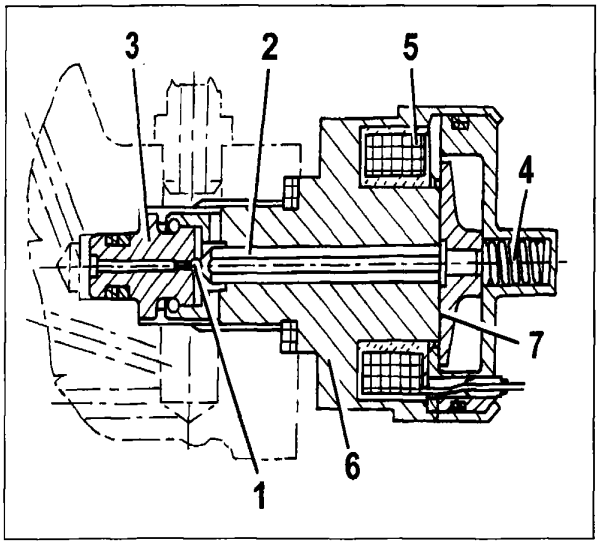
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4F019NJ01




4F019NJ02




4F019NJ03

## PRESSURE PUMP

The pressure pump is the radialjet type with three radial pistons (total capacity 0.657 cc) and is operated by the timing belt without timing restrictions.

Each pumping unit consists of:

a piston (5) operated by a cam (2) fixed to the pump shaft (6);

an inlet valve (3);

a supply ball valve (4).

The pressure pump should receive a supply of at least 0.5 bar; for this reason the fuel system is equipped with an auxiliary electric pump immersed in the tank.

The pressure pump is lubricated and cooled by the same diesel fuel by means of suitable ducts and is capable of supplying a maximum pressure of 1350 bar.

1. Cylinder
2. Cam
3. Inlet valve
4. Supply ball valve
5. Piston
6. Pump shaft
7. Diesel inlet connector - low pressure - from fuel filter
8. Diesel supply connector - high pressure - to manifold (rail)
9. Diesel supply connecotr - low pressure – recirculation

## FUEL PRESSURE REGULATOR

The fuel pressure sensor is fitted on the pressure pump and operated directly by the injection control unit, regulating the fuel supply pressure to the injectors.

The pressure regulaor consists mainly of the following components:

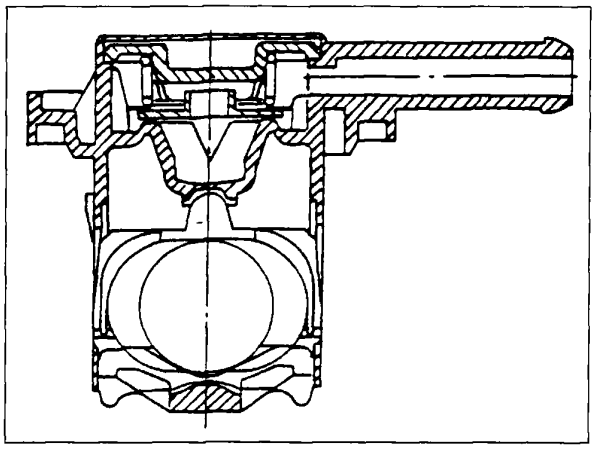
1. Ball shutter
2. Pin
3. Valve
4. Pre-loading spring
5. Coil
6. Corpo
7. Keeper

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# 10.



4F020NJ01

## MULTI-PURPOSE VALVE

The multi-purpose valve is lcoated on the fuel tank and carries out the following tasks:

- pressurizing the tank
- ventilation
- seal in case of overturning

### Pressurizing the tank

The tank pressure is kept at between 55 and 75 mbar by means of a valve resting on a sealing edge.

The valve is supported by a steel plate and opposed by a spring.

When the pressure in the tank exceeds the recommended value, it overcomes the resistance of the spring allows the valve to lift, thereby allow the flow of vapours.

When the pressure returns to within the limits, the valve closes again.

### Ventilation

In certain operating conditions, a vacuum may form in the tank through the effect of:

- heat variations;
- fuel consumption.

The function of the valve, under these circumstances, is to restore the pressure inside the tank through the intake of air.

Any problem with this function can cause irregular operation or the breakdown of the vehicle through problems with the electric pump supply.

### Seal in the case of overturning

The roll-over function is to prevent the escape of fuel from the tank if the vehicle overturns or is at a very steep angle.
During the normal operation of the vehicle (bends, acceleration, braking, etc.) the fuel is shaken around in the tank and may spill out.
The high sensitivity of this valve to roll-over prevents these escape.

## SUPPLY MANIFOLD (RAIL)

The supply manifold (rail) is fitted on the cylinder head, inlet side.

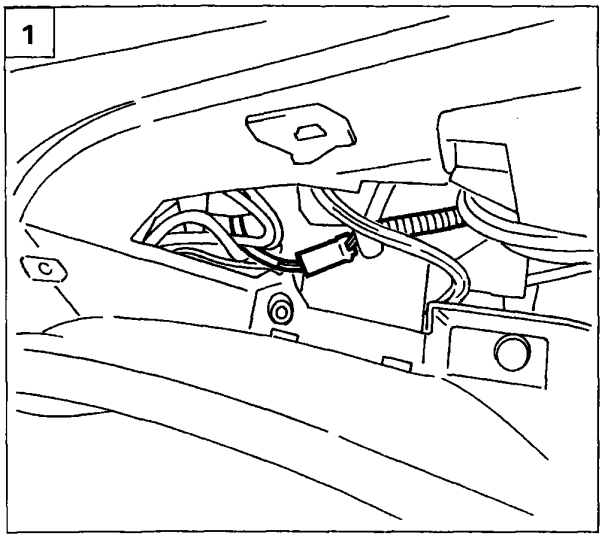
With its volume it dampens the pressure fluctuations of the fuel due mainly:

- to the operation of the pressure pump;
- to the opening of the injectors.

The fuel pressure sensor is fitted in the centre of the supply manifold.
The (high pressure) hydraulic connections are achieved through special steel pipes.



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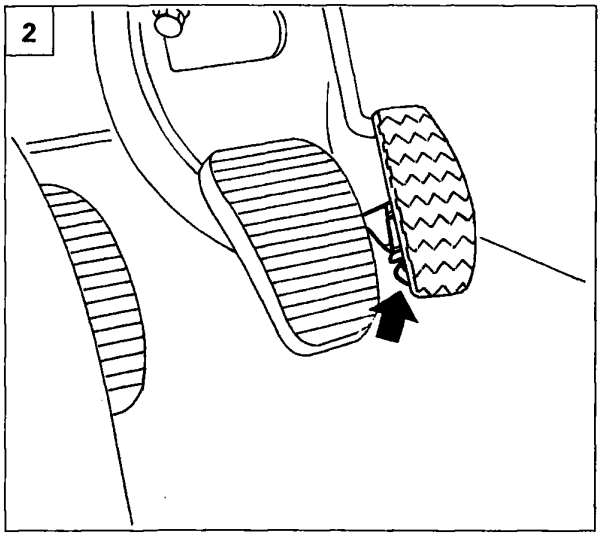
2387 JTD

2387 JTD

1. Disconnect the electrical connector for the potentiometer cutting off the wiring as close as possible to the plastic duct which retains it, taking care not to damage the surrounding cables.

**REFITTING**

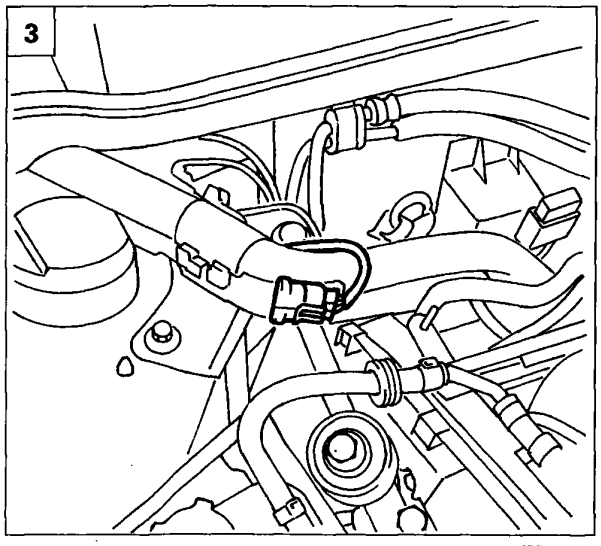
- Carry out the operations described above in the reverse order.
- Position the new potentiometer and restore the routing of the new bridge fastening it under the tunnel so that the latter does not impede the movement of the climate control unit and does not produce noise/vibrations whilst the vehicle is being driven.




4F47MJ03

2. Connect the diagnostic equipment to the socket in the engine compartment, on the right side of the vehicle, in the area of the pillar.

**With the pedal in the end of travel position, check that the voltage reading on the instrument is 3.8V ± 1V.**




4F47MJ02

3. To correct the voltage readings with the accelerator in the maximum position, regulate the adjustment device and repeat the measuring procedure using the diagnostic equipment.



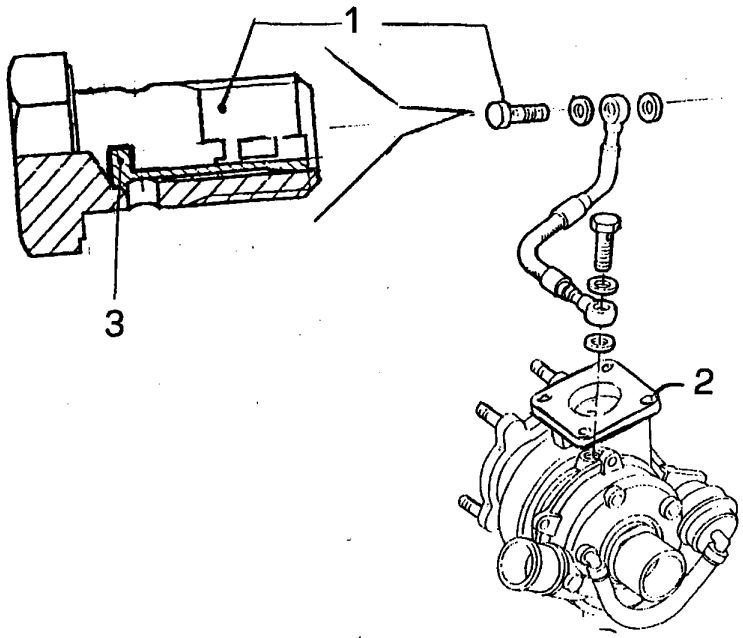
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# 10.

## SERVICING INSTRUCTIONS TO BE FOLLOWED WHEN DISMANTLING THE TURBOCHARGER

In the case of "major" repairs to the engine (e.g. overhauling) or when the turbocharger assembly (2-Fig.1) is dismantled it is necessary to replace the filler (1) no. **4640121** for the connector for the flexible supply pipe to the turbo (cylinder block/crankcase side) when there is an oil filter (3) fitted as illustrated in figure 1.

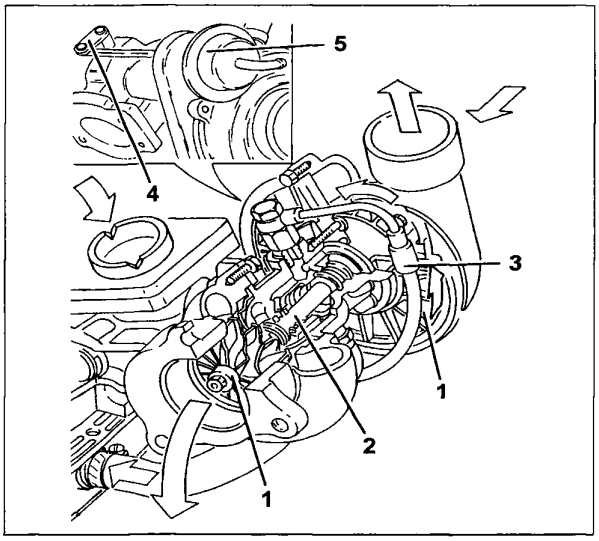
Fig. 1




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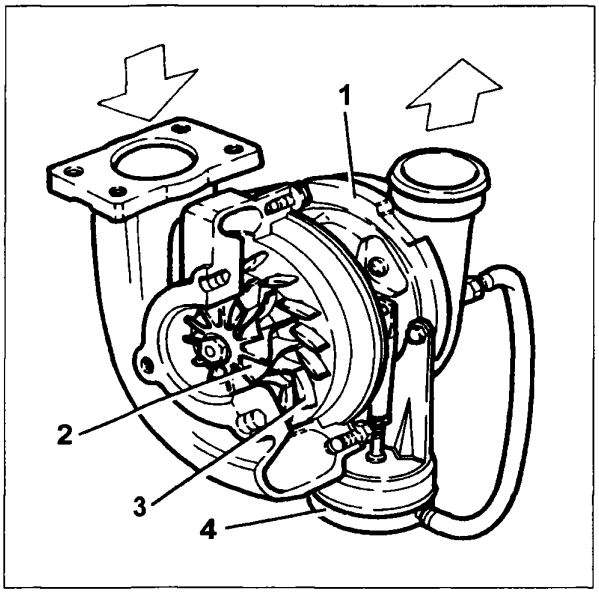



4F023NJ01

## TURBOCHARGER 1910 JTD

It basically consists of two impellers (1) fitted on the same shaft (2) which rotates on floating bearings lubricated via a duct (3) in the engine lubrication circuit.
The oil used dissipates part of the large amount of heat given off by the exhaust gases.
There is a waste-gate valve (4) fitted on the turbocharger, operated by a pneumatic actuator (5), which makes it possible to shutter the flow of exhaust gases to the turbine according to the engine power/torque requirements.

1. Impellers
2. Shaft
3. Lubrication
4. Waste-gate
5. Actuator




4F023NJ02

## TURBOCHARGER 2387 JTD

This is a variable geometry turbocharger, connected to the exhaust manifold; it is designed to increase the engine thermal output.

The variable geometry turbocharger consists of:
- a centrifugal compressor (1)
- a turbine (2)
- a series of moving vanes (3)
- a pneumatic actuator (4) controlling the moving vanes.

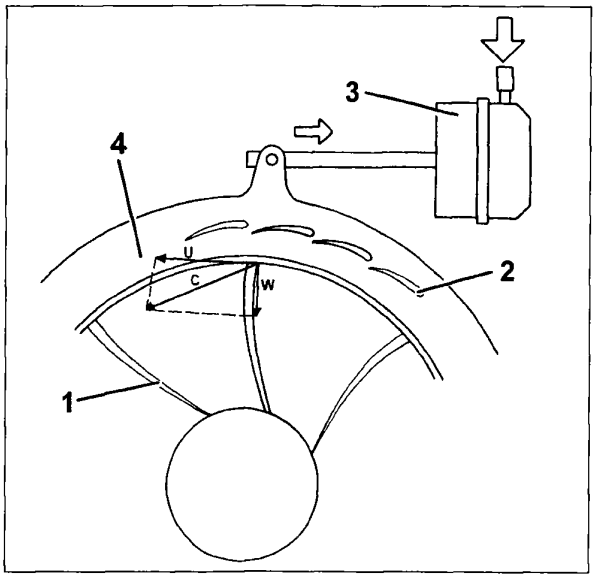
The variable geometry turbocharger makes it possible to:
- increase the speed of the exhaust gases coming into contact with the turbine at low engine speeds
- slow down the speed of the exhaust gases coming into contact with the turbine at high speeds.

The control of the speed (kinetic energy) of the exhaust gases makes it possible to have greatre engine torque at low speeds and increased maximum power at high speeds.



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# 10.

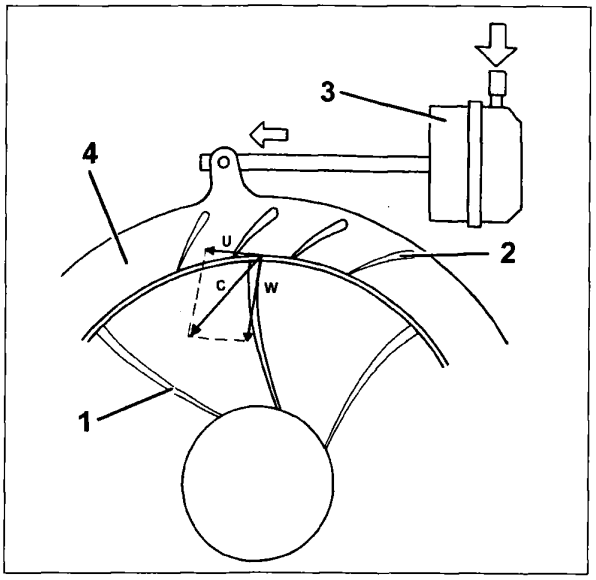



4F024NJ01

### Operation at low rotation speeds

When the engine is rotating slowly, the exhaust gases possess a small amount of kinetic energy: under these circumstances a traditional turbine would rotate slowly, providing a limited supercharging pressure.
In the variable geometry turbine (1) on the other hand, the moving vanes (2) are in the fully closed position and the small sections between the vanes increase the speed (**C**) of the inlet gases.
Increased inlet speeds involve increased peripheral speeds (U) of the turbine and consequently the compressor.
The speed of the gases flowing inside the impeller is indicated by the vector (W).

1. Turbine
2. Moving vanes
3. Pneumatic actuator
4. Rotary seal




4F024NJ02

### Operation at high rotation speeds

Increasing the engine rotation speed gradually increases the kinetic energy of the exhaust gases.
As a result, the speed of the turbine (1) increases and therefore the pressure of the supercharging, also acting on the actuator (3).
The actuator (3) opens the moving vanes (2), by means of a rod, according to the supercharging pressure, until the fully open position is reached.
The section therefore increases and there is a consequent slowing down in the flow of the exhaust gases passing through the turbine (1) with speeds equal to or less than the low speed condition.
The speed of the turbine (1) decreases and settles down at a suitable value for the correct operation of the engine at high speeds.

1. Turbine
2. Moving vanes
3. Pneumatic actuator
4. Rotary seal

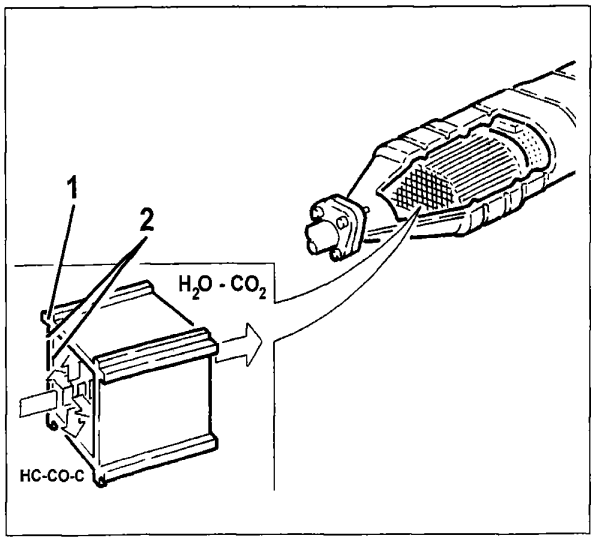
## EXHAUST GAS CIRCUIT

The engine exhaust gases flow through the manifold to the turbocharger and then, by means of a pipe, to the catalytic converter and the silencer.
Special protection limits the heat transmitted to the bodyshell.



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## EMISSION CONTROL DEVICES

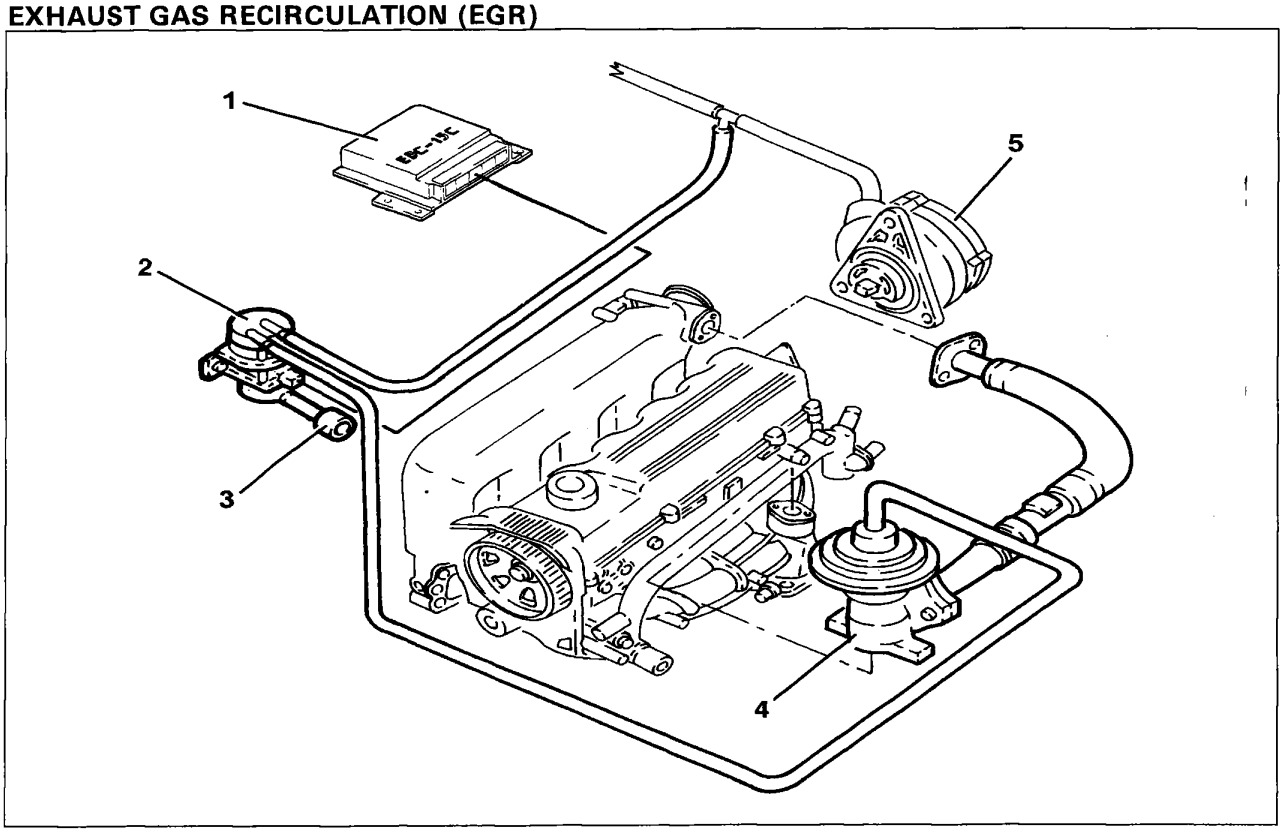



4F025NJ01

### CATALYTIC CONVERTER

The catalytic converter is a post-treatment device for oxidizing the CO, the HC and the particulates, transforming them into carbon dioxide (CO 2) and water vapour (H2O).
The catalyzer consists of a ceramic honeycomb monolith (1), whose cells are impregnated with platinum (2) which acts as a catalyst for the oxidation reactions.
The exhaust gases passing through the cells heat the catalyzer, triggering off the conversion of the pollutants into inert compounds.
The chemical oxidation of the CO, HC and particulates, is effective at temperatures of between 200 °C and 350 °C.
Above 350 °C the sulphur contained in the diesel fuel starts to oxidize producing sulphur dioxide.

## EXHAUST GAS RECIRCULATION (EGR)




4F025NJ02

This system makes it possible to send some of the exhaust gases to the inlet in certain engine operating conditions.
This dilutes the fuel mixture with inert gases lowering the peak temperature in the combustion chamber; this contains the formation of nitrogen oxides (NOx) producing a 30-50% reduction at the exhaust.



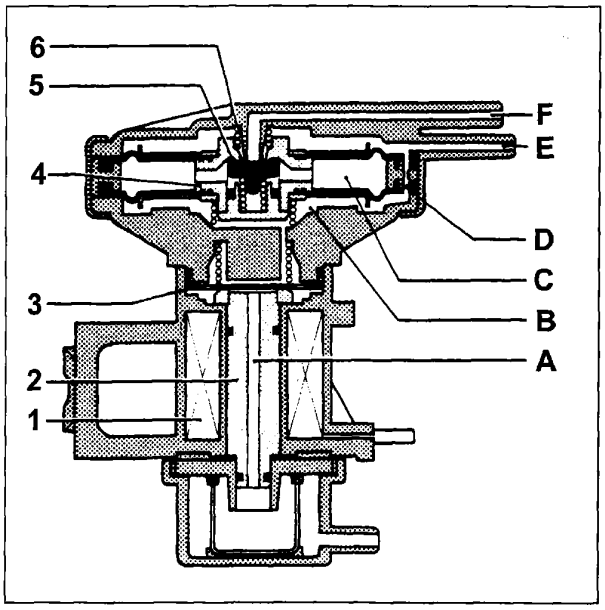
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The recirculation of the exhaust gases is only permitted at medium-low loads, when the air/fuel ratio is very high and the operation of the engine is not adversely affected by the presence of inert gases in place of the air.
The recirculation is controlled by the injection control unit (1) which, mainly according to the signals from the accelerator pedal potentiometer, the rpm sensor and the engine coolant temperature senor, supplies an output signal for the modulating solenoid valve (2).
The latter, connected to the atmosphere by means of a filter (3), transmits a lesser or greater vacuum, according to the signal received, coming from the brake servo vacuum pump (5) to the EGR valve.
If the vacuum is sufficient, the valve (4) opens placing the exhaust manifold in contact with the inlet manifold.

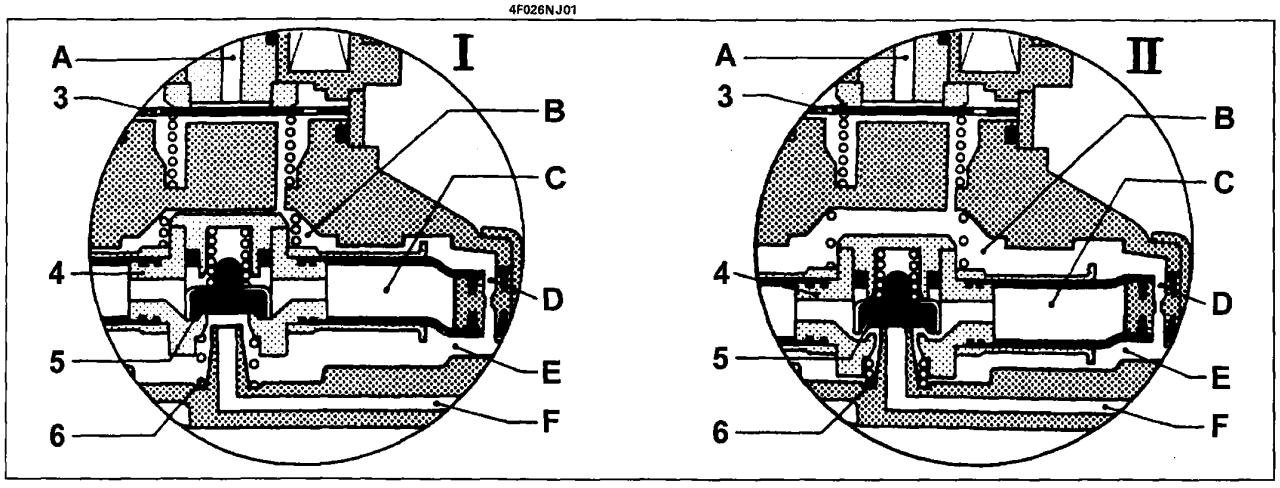
**EGR MODULATING SOLENOID VALVE**

The vacuum coming from the vacuum pump for the brake servo reaches the chamber (E) from the duct (F) (case I) because the force of the spring (6) acts on the moving element (4) and the valve (5) allows its flow.
The vacuum then enters the chamber (B), through the compensation port (D) and the surface of the disc shuter (3).
When the forces acting on the disc (3) are balanced, the atmospheric pressure in the duct (A) enters the chamber (B), moving the moving element downwards (case II), therefore the valve (5) shutter closes the duct (F) and places chamber (E) in contact with chamber (C) at atmospheric pressure, decreasing the vacuum in the duct (E).




4F026NJ01

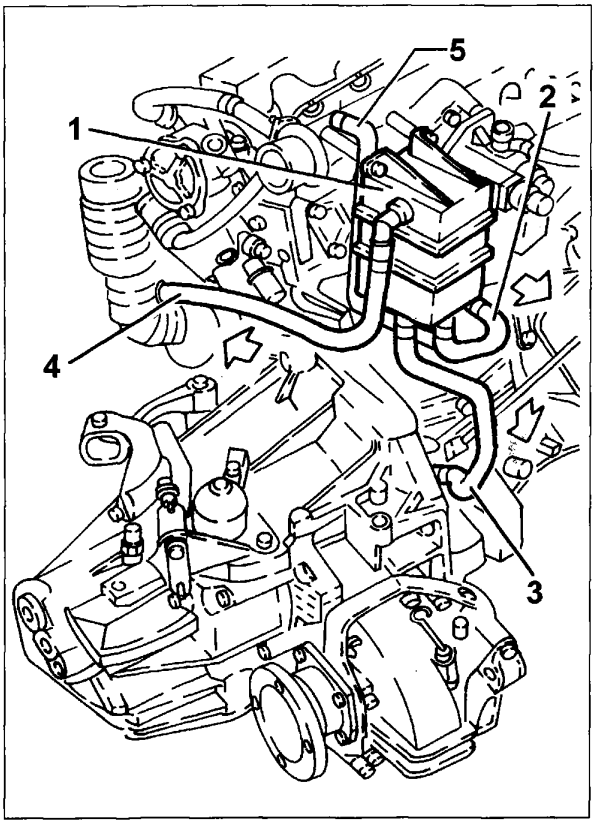
The decreased vacuum value or the increased absolute pressure in the chamber (E) raises the moving element (4) (case I), closing the section (C) and placing the valve (5) in the ideal condition (E in contact with F) and the cycle is repeated.




4F026NJ02



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4F027NJ01

## RECIRCULATION CIRCUIT FOR VAPOURS COMING FROM THE CRANKCASE (BLOW-BY)

The engine crankcase emissions consist of air/diesel mixtures and burnt gases which escape through the piston seals as well as lubricant oil vapours.

These are defined as blow-by or breather gases.

The breather gases coming from both the crankcase (2) and the cylinder head (5) reach the separator (1).

In the separator (1) the gases lose part of the oil dissolved in them which returns to the sump in the form of droplets via the pipe (3).

The remaining gases, on the other hand, are directed to the intake circuit via the pipe (4).



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page

## FUEL SYSTEM

- Introduction 1
- General diagram of fuel system 2
- Location of components of fuel system 3
- Input/output signals between control unit and sensors/actuators 4
- Functional diagram of fuel system 6
- Air temperature sensor 7
- Engine coolant temperature sensor 7
- Hot-film air flowmeter 8
- Wiring diagram 10
- Control unit pins 12

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## INTRODUCTION

From chassis no. 205884, a new hot-film flowmeter has been adopted instead of the vane-type flowmeter.

The hot-film flowmeter is more precise and, as it has no moving parts, it is more reliable than the previous version.

With the introduction of the new flowmeter, other parts have also been affected by the modification; in addition to the hot-film flowmeter the new parts (added or modified) relating to the fuel system are as follows:

- Modified air duct connecting air cleaner to flowmeter.
- Modified air duct connecting flowmeter to turbine.
- Modified flowmeter mounting bracket.
- Replaced engine coolant temperature sender unit with a new sender unit which comprises two separate sensors: one for the fuel injection and one for the instrument panel gauge.
- Added intake air temperature sender unit which is no longer built into the flowmeter, but is a single component located upstream of the new hot-film flowmeter.
- Modified fuel injection pump: on the fuel outlet connection for the return to the tank, the 0.75 mm calibrated hole has been replaced with a valve calibrated at the pressure of about 4 bar; this allows the pump not to empty and to keep fuel under pressure in it, thus ensuring better engine starting.

- New Bosch 0.432.217.297 fuel injectors.
- New Bosch 0.432.217.296 instrumented fuel injector.
- New MSA 11 Bosch 0.281.001.741 fuel injection electronic control unit.
- New fuel injection wiring for connection to the new sensors.

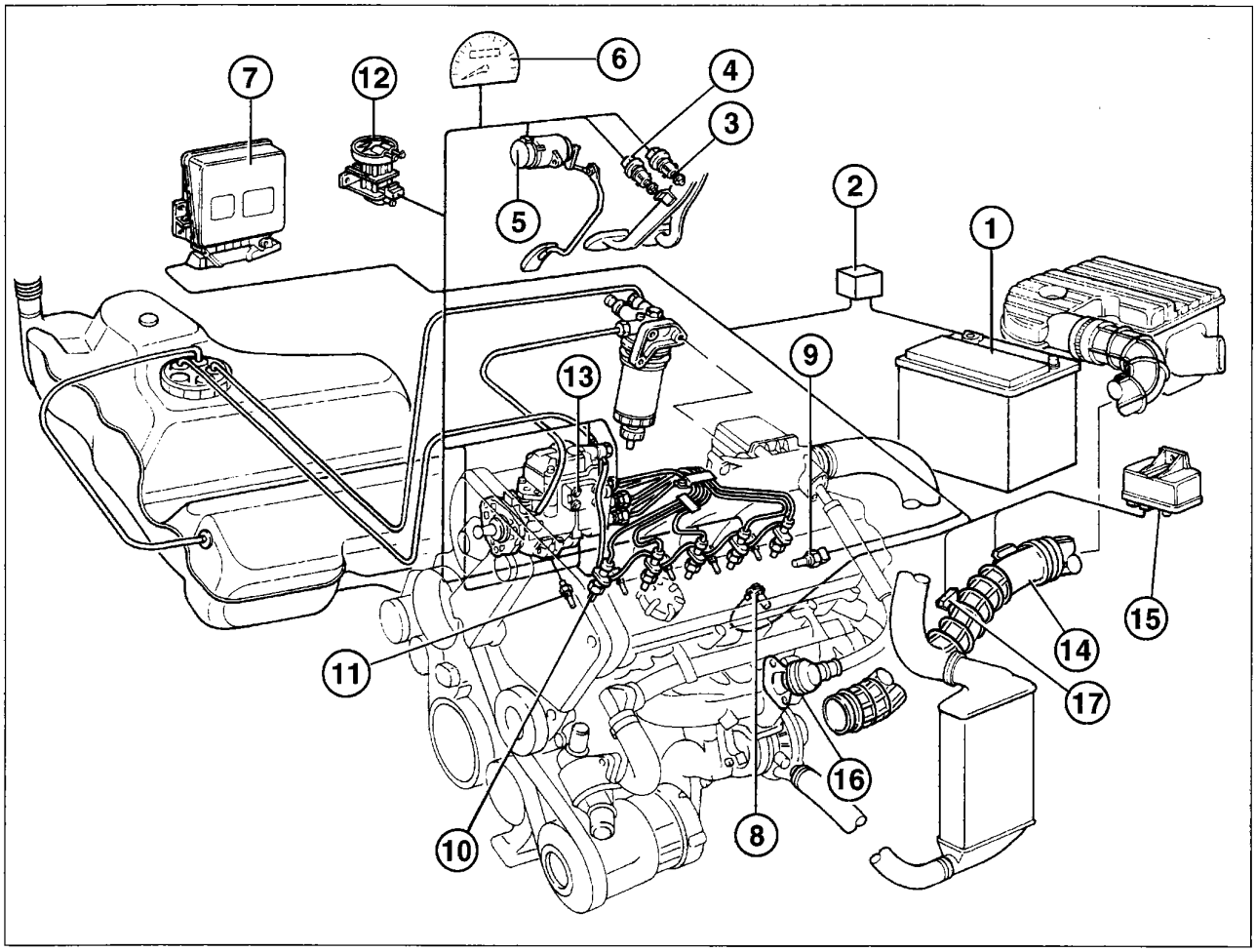
This section only covers the parts of the 2387 TD engine fuel system which are different in relation to the previous version.

For aspects not covered in the following pages, see the descriptions give in the "Fuel system of 2387 TD" in the basic edition, contained in volume 1.

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## GENERAL DIAGRAM OF FUEL SYSTEM



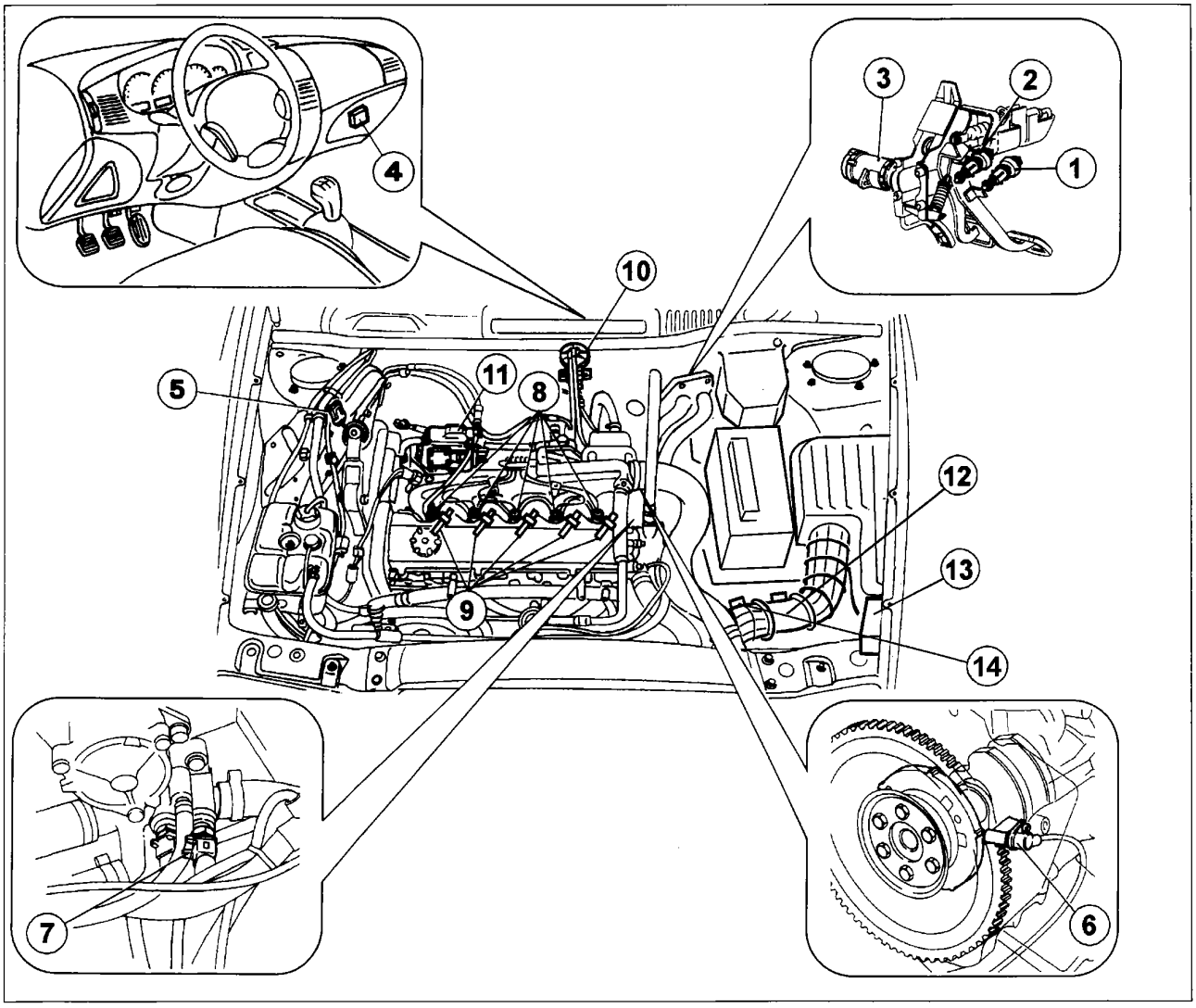

P4F02LJ01

1. Battery
2. Relay
3. Clutch pedal switch
4. Brake pedal switch
5. Accelerator potentiometer
6. Speedometer
7. Electronic control unit
8. Engine rpm sensor
9. Coolant temperature sensor
10. Instrumented fuel injector
11. Heater plugs
12. Borg-Warner modulating valve
13. Bosch fuel injection pump
14. Flowmeter
15. Plug preheating control unit
16. E.G.R. valve
17. Intake air temperature sensor



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## LOCATION OF FUEL SYSTEM COMPONENTS




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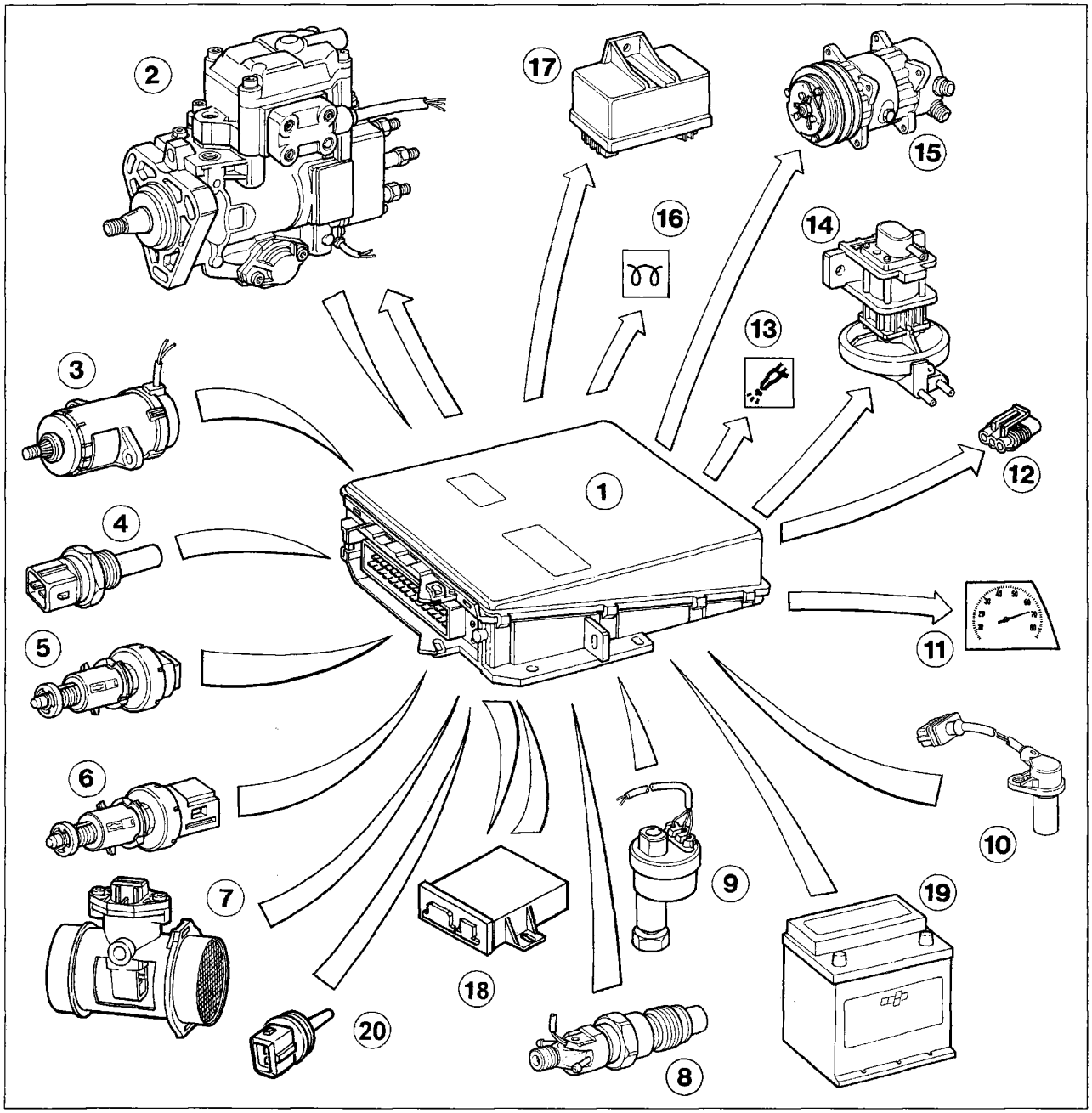
1. Clutch pedal switch
2. Brake pedal switch
3. Accelerator potentiometer
4. Electronic control unit
5. Diagnostic socket
6. Engine rpm sensor
7. Coolant temperature sensor
8. Fuel injectors
9. Heater plugs
10. Borg Warner modulating valve
11. Bosch fuel injection pump
12. Flowmeter
13. Plug preheating control unit
14. Intake air temperature sensor

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## INPUT/OUTPUT SIGNALS BETWEEN CONTROL UNIT AND SENSORS/ACTUATORS




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1. Electronic control unit
2. Injection pump
3. Accelerator pedal potentiometer
4. Engine coolant temperature sensor
5. Clutch pedal switch
6. Brake pedal switch
7. Air flowmeter
8. Instrumented fuel injector
9. Speedometer sensor
10. Engine rpm sensor
11. Rev counter
12. Diagnostic socket
13. Fuel injection fault warning light
14. Borg Warner solenoid
15. Air conditioner
16. Heater plugs warning light
17. Plug preheating control unit
18. Fiat CODE control unit
19. Battery
20. Intake air temperature sensor



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The BOSCH MSA11 electronic control unit (1) receives the following information:

- accelerator pedal position from the potentiometer connected to it (3);
- engine rpm from the sensor mounted on the engine block (10);
- intake air quantity from the flowmeter (7);
- quantity of fuel injected from the sensor mounted on the actuator contained in the fuel injection pump (2);
- intake air temperature from the relevant sensor (20);
- diesel temperature from the sensor located in the fuel injection pump (2);
- coolant temperature from the sensor (4);
- actual start of injection (opening of fuel injector pintle) from the instrumented fuel injector (8), located on cylinder 1;
- car speed from speedometer sensor (9) located on the gearbox;
- brake operation information from the switch (6) located on the brake pedal;
- clutch operation from the switch (5) located on the clutch pedal;
- atmospheric pressure from the sensor located inside the control unit (1);
- signal requesting the switching on of the air conditioner compressor from the air conditioning system (15).

Depending on the input values, the electronic control unit (1) consults the mapped values in its memory and corrects the output values accordingly, thus managing:

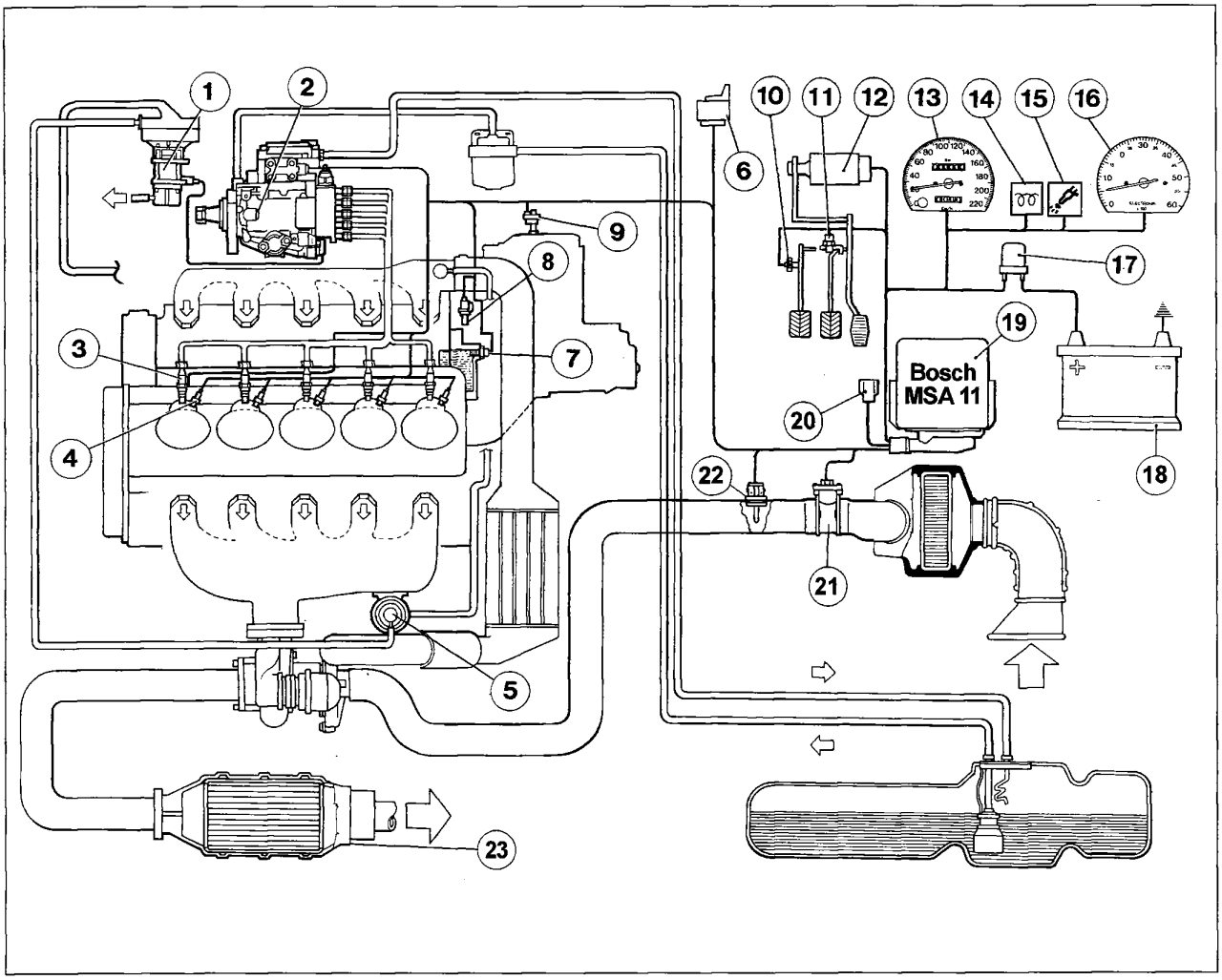
- the actuator controlling the quantity of fuel contained in the fuel injection pump (2);
- the fuel injection advance regulation solenoid contained in the fuel injection pump (2);
- the engine stop solenoid contained in the fuel injection pump (2);
- the heater plug control unit (17);
- the Borg Warner (14) vacuum modulating solenoid controlling the E.G.R. valve;
- the heater plugs warning light (16);
- the fuel injection fault warning light (13);
- the rev counter (11);
- the engagement of the air conditioner compressor electromagnetic clutch (15);
- the diagnostic socket (12).

The control unit also has the function of blocking engine starting (Fiat CODE).
This function is carried out by a specific control unit (Fiat CODE) (18), which can dialogue with the electronic control unit (1), and an electronic key with a special transmitter for sending a recognition code.



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## FUNCTIONAL DIAGRAM OF THE FUEL SYSTEM

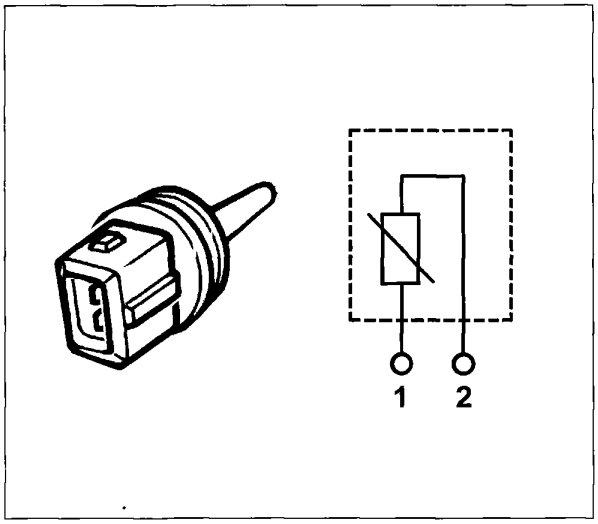



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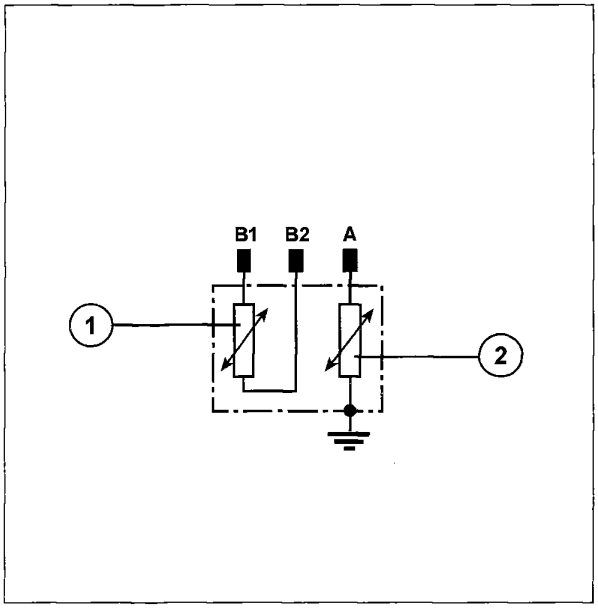
1. Borg Warner modulating valve
2. Bosch fuel injection pump
3. Instrumented fuel injector
4. Heater plug
5. EGR valve
6. Plug preheating control unit
7. Coolant temperature sensor
8. Engine rpm sensor
9. Speed sensor
10. Clutch pedal sensor
11. Brake pedal sensor
12. Accelerator potentiometer
13. Speedometer
14. Heater plug warning lamp
15. Fuel injection fault warning light
16. Rev counter
17. Relay
18. Battery
19. Fuel injection control unit
20. Diagnostic socket
21. Air flowmeter
22. Intake air temperature sensor
23. Catalytic converter



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## AIR TEMPERATURE SENSOR

On this version, the intake air temperature sensor is separate from the air flowmeter; it is an ordinary NTC (Negative Temperature Coefficient) sensor, whose electrical resistance decreases as temperature increases.

As the input circuit into the control unit is designed as a voltage divider, this voltage is divided between a resistor present in the control unit and the sensor's NTC resistor. The control unit can therefore assess the changes in the sensor's resistance from the changes in voltage, and thus obtain the temperature information.

## COOLANT TEMPERATURE SENSOR

The sensor consists of a brass casing which houses the actual resistive elements, which are two NTC (Negative Temperature Coefficient) thermistors; the electrical resistance of the sensor decreases as the temperature increases.
The two NTC thermistors are separate, and they supply the temperature information to the specific gauge on the instrument panel and the fuel injection-ignition control unit.
For the NTC element relating to the fuel injection, the reference voltage is 5 Volt; as the input circuit into the control unit is designed as a voltage divider, this voltage is divided between a resistor present in the control unit and the sensor's NTC resistor. The control unit can therefore assess the changes in resistance of the sensor through the changes in temperature.

1. NTC for fuel injection
2. NTC for instrument panel gauge

The tables opposite give the resistance values which the NTC elements can assume in accordance with the coolant temperature.

**INJECTION NTC**

| °C | Ω | °C | Ω |
|---|---|---|---|
| -20 | 15970 | 40 | 1150 |
| -10 | 9620 | 50 | 807 |
| 0 | 5975 | 60 | 576 |
| 10 | 3816 | 70 | 418 |
| 20 | 2500 | 80 | 309 |
| 25 | 2044 | 90 | 231 |
| 30 | 1679 | 100 | 176 |

**GAUGE NTC**

| °C | Ω |
|---|---|
| 60 | 512-602 |
| 90 | 184-208 |
| 120 | 76-88 |



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# 10.

## HOT-FILM AIR FLOWMETER

This component measures the quantity of air drawn in by the engine. The electrical signal (proportional to the air flow) which the flowmeter gives as an output is sent to the engine control unit. This is used to:
- calculate the quantity of fuel to be injected, so as to obtain the maximum fuel flow rate while maintaining an acceptible level of smoke in the exhaust;
- check the quantity of gases recirculating through the EGR valve.

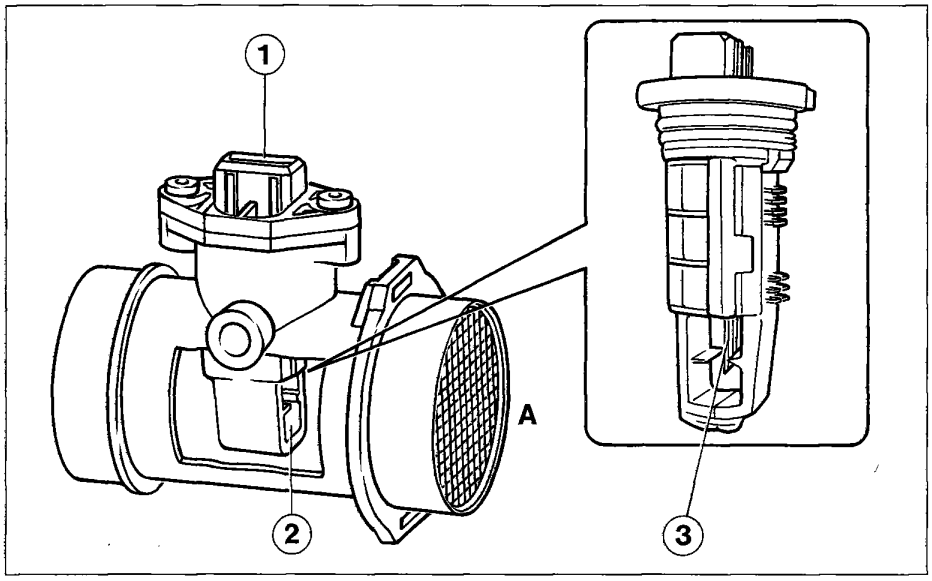
The check on the quantity of recirculating gases is based on the following equation:

**Qam - Qar = Qgr**

Qam = quantity of theoretical air mapped in the control unit in a particular point of engine operation;
Qar = quantity of air which really passes through the flowmeter (and is drawn in by the engine) at the same point of engine operation;
Qgr = the imbalance, compared with the theoretical value, of the quantity of recirculating gases.

If the quantity of recirculating gases is correct for a particular point of engine operation, the quantity of air drawn in by the engine must be the same as the mapped quantity. Thus Qgr must be zero. If Qam is greater than Qar, this means that the quantity of air passing through the flowmeter is less than the theoretical quantity, i.e. the quantity of recirculating gases is higher than the specified value (Qgr > 0). In this case the control system intervenes on the EGR valve to reduce the flow rate, so that the Qgr value is cancelled.

The system behaves in the same way if Qar > Qam.




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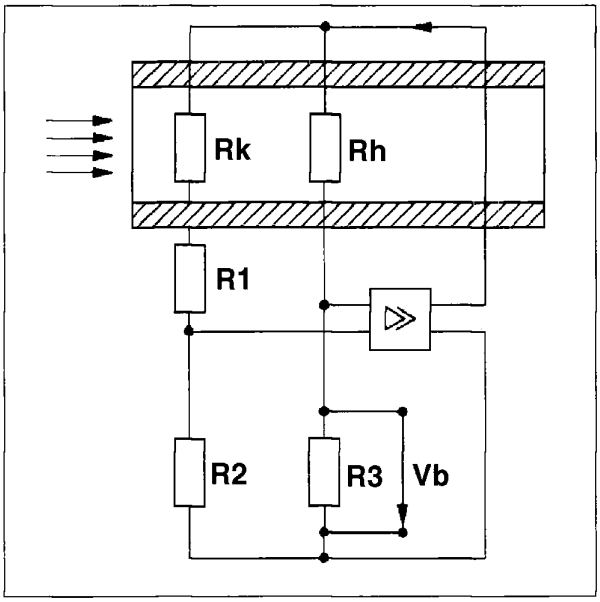
1. Connector
2. Measuring channel
3. Hot-film sensor
A = Air input

The "hot-film" air flowmeter.
The operating principle of these sensors is based on the heat exchange between a "hot" element and the air flow enveloping it.
The heat exchanged is given by the electrical power supplied by the power supply to the hot element, to keep its temperature constant.



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The principle of operation of the flowmeter may be observed from the following wiring diagram of the electrical circuit which drives the sensor:




P4F09LJ01

Wiring diagram

Rh = hot film

Rk = temperature compensation sensor

R1, R2, R3 = bridge resistors

In the diagram, the component Rh represents the hot sensor, which is kept at constant temperature in relation to the air temperature.
An increase in the quantity of air enveloping the hot element causes it to cool down, and so reduces its resistance, unbalancing the bridge.
The circuit restores the balance of the bridge by increasing the current supplied to the hot element until its resistance (and so its temperature) assumes the original balanced value.
The increase in current which passes through the hot element is proportional to the air flow passing through the flowmeter. This value thus gives the air flow: to measure precisely the current passing through the hot film, the voltage at the ends of the fixed resistor R3 is measured; this voltage thus provides the information on the mass of air passing through the flowmeter.

To compensate for the measurement error due to the variation in air temperature, the resistor Rk is in parallel to the hot film. Its high value only changes when the air temperature changes, compensating for the increase in resistance of the hot sensor, so the bridge does not undergo unbalancing due to the variation in the air temperature.

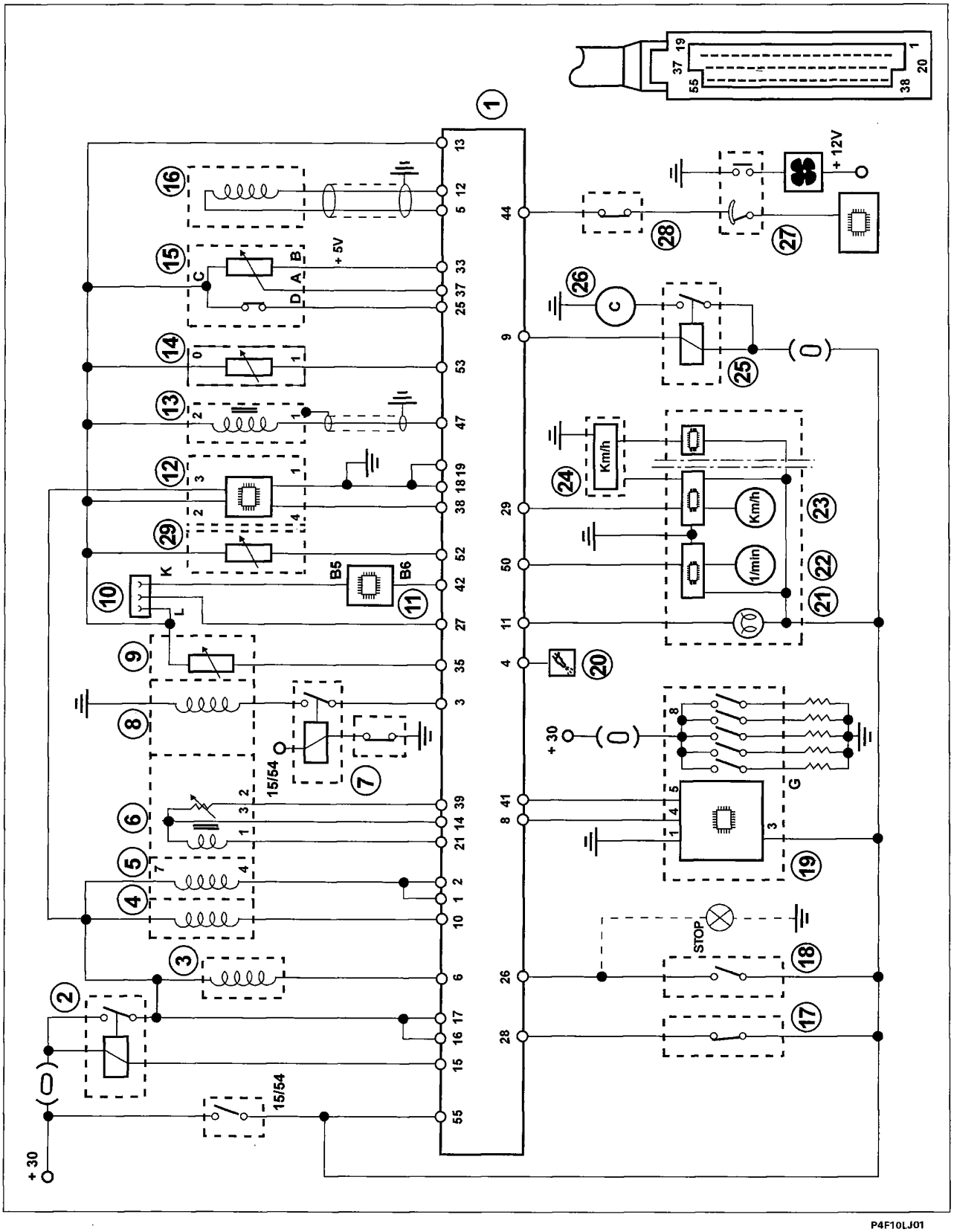
The hot element consists of platinum. For the same area, film technology offers shorter response times than hot wire. In addition, having a larger area than wire, it has greater immunity to inorganic contamination.

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# 10.

## WIRING DIAGRAM

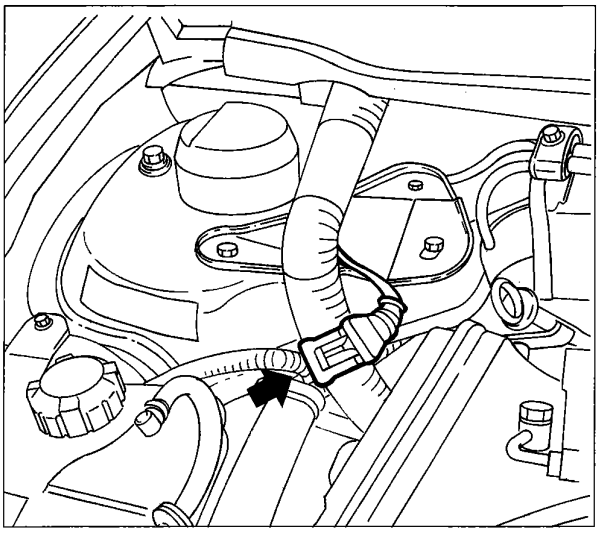





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**Key to wiring diagram**

1. Electronic control unit
2. System protection relay
3. Borg-Warner modulating solenoid
4. Fuel injection advance actuator
5. Fuel quantity actuator
6. Fuel quantity actuator position control
7. Inertial switch
8. Engine cut-out solenoid
9. Fuel temperature sensor
10. Diagnostic socket
11. Immobilizer
12. Flowmeter
13. Engine rpm sensor
14. Engine coolant temperature sensor
15. Accelerator pedal potentiometer with idle switch
16. Instrumented fuel injector
17. Clutch pedal switch
18. Brake pedal switch
19. Plug preheating electronic control unit
20. System fault warning light
21. Plug preheating warning light
22. Rev counter
23. Speedometer
24. Speedometer sensor
25. Air conditioner compressor relay
26. Air conditioner compressor
27. Three-stage pressure switch
28. Anti-frost thermostat
29. Air temperature sensor



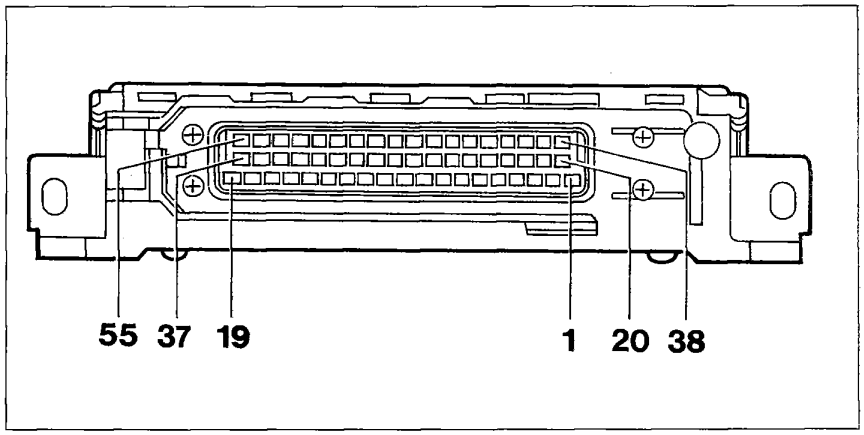
P4F21FJ01

Location of diagnostic socket



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## CONTROL UNIT PINS




1. Fuel flow actuator
2. Fuel flow actuator
3. Engine cut-out solenoid
4. Infocenter
5. Instrumented fuel injector
6. E.G.R. solenoid
7. Not connected
8. Activation of plug preheating control unit
9. A.C. compressor
10. Fuel injection advance actuator
11. Heater plugs "on" warning light
12. Earth for instrumented fuel injector
13. Sensors' shared earth
14. Cursor position sensor
15. Main relay
16. Control unit supply through relay
17. Control unit supply through relay
18. Earth
19. Earth
20. Not connected
21. Cursor position sensor (reference winding)
22. Not connected
23. Not connected
24. Not connected
25. Idle switch on accelerator pedal
26. Stop lights switch
27. Not connected
28. Clutch pedal switch
29. Vehicle speed signal
30. Not connected
31. Not connected
32. Not connected
33. 5V accelerator pedal position sensor
34. Not connected
35. Fuel temperature signal
36. Not connected
37. Accelerator pedal position signal
38. Flowmeter signal
39. Cursor position sensor signal
40. Not connected
41. Heater plug operation signal
42. Line K and immobilizer
43. Not connected
44. Signal required for switching on compressor
45. Not connected
46. Not connected
47. Engine rpm sensor
48. Not connected
49. Not connected
50. Rev counter signal
51. Not connected
52. Air temperature signal
53. Engine coolant temperature signal
54. Not connected
55. Ignition key positive



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page

**ANTI-LOCK BRAKES (A.B.S. LUCAS VARITY EBC 430)**

- Composition 1
- Electro-hydraulic control unit 2
- Wheel rpm sensors (active) 6
- Description of the operation of the anti-lock braking system 9
- Diagram showing A.B.S. hydraulic system 14
- Wiring diagram for A.B.S. LUCAS Varity EBC 430 system 17

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# ANTI-LOCK BRAKES (LUCAS Varity EBC 430)

## COMPOSITION

The Varity EBC **430** system is extremely compact (easy to fit), light and reliable.
The use of new microhybrid electronic components, the improvement of the mangetic flows achieved thanks to the design of new compact shapes for the valve bodies and the reduction in the number of hydraulic components achieved through the direct pressing of the jets in the valve seat, have made it possible to improve the modular features of the solenoid valves.
In addition to the anti-locking function, the system controls the distributing of the braking force between the front and rear axles through the EBA function (Electronic Brake Apportioning) thereby eliminating the need for the conventional load proportioning valve in hydraulic braking systems.

The main system components are:
- electronic control unit;
- electro-hydraulic control unit which modulates the braking pressure at the brake calipers by means of eight solenoid valves, two for each wheel;
- four active sensors, one for each wheel, which measure the angular rotation speed of the actual wheels.

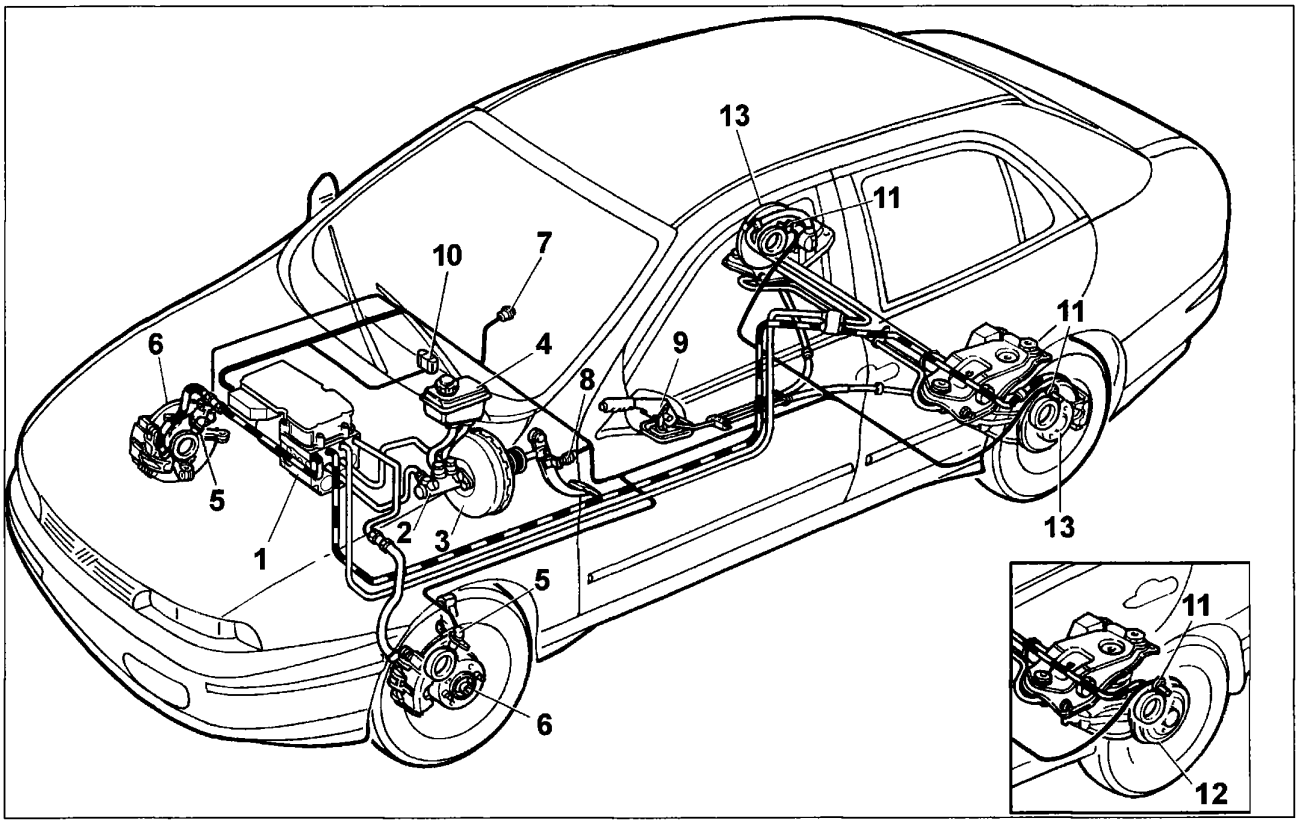



**Diagram showing Lucas Varity EBC 430 anti-lock braking system**

1. Electro-hydraulic control unit with electronic control unit incorporated
2. Master cylinder for front and rear brake circuit
3. Vacuum servo brake
4. Brake fluid reservoir
5. Front wheel rpm sensor
6. Front disc brakes
7. Instrument panel (ABS and braking system failure warning light)
8. Brake lights switch
9. Handbrake switch
10. Diagnostic socket
11. Rear wheel rpm sensor
12. Rear drum brakes
13. Rear disc brakes



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The system is completed by:
- the hydraulic system pipes;
- specific electric wiring;
- a switch on the brake pedal for detecting the braking condition;
- an ABS warning light and a braking system failure warning light, in the instrument panel.

## ELECTRO-HYDRAULIC CONTROL UNIT

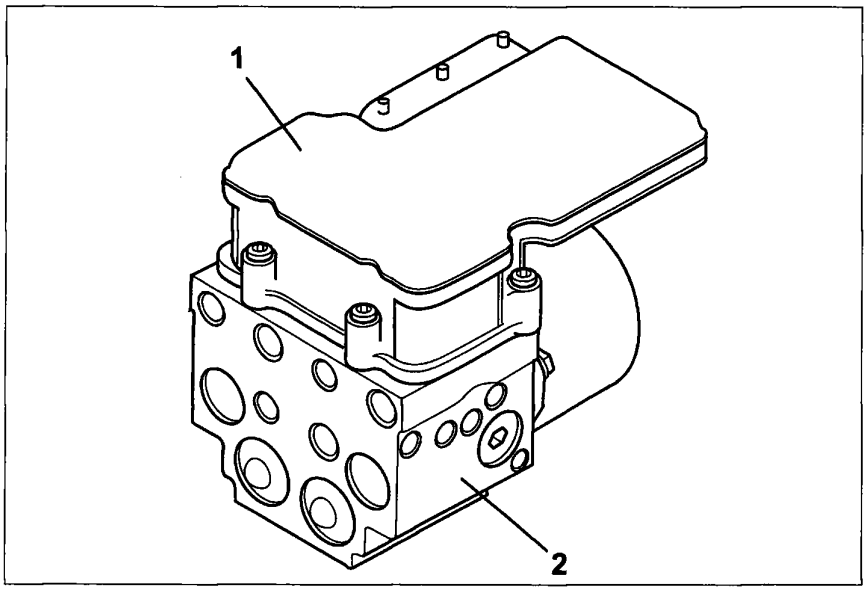
The electro-hydraulic control unit is composed of two sections fixed to one another: an electronic control unit and an electro-hydraulic control unit.
The electronic control unit is connected to the A.B.S. wiring by means of a multiple connector.
On the basis of the signals coming from the sensors and with the aid of programmes stored in its memories, the electronic control unit operates the electro-hydraulic control unit.
The electro-hydraulic control unit is connected to the brake pump and the A.B.S. components through the braking system pipes.

### Electronic control unit

The electronic control unit is made up of hybrid circuits with resistances, diodes, transistors and integrated logic circuits. The core of the system comprises two CMOS microprocessors with 24 K of ROM. The main 16 bit processor calculates the ABS responses and constantly controls the operation of the system, ensuring the safety (fail-safe), whilst the 8 bit (secondary) processor independently checks the wheel speed signals; when the results obtained correspond, the electronic control unit issues the operating command to the electro-hydraulic control unit.

If this is not the case, if, for example, there is a fault in the anti-lock braking system, the device excludes itself and braking takes place conventionally; at the same time, the failure warning light in the instrument panel comes on.

The information relating to the fault is recorded in a non volatile memory; in effect, one of the two microprocessors has a CMOS EEPROM memory whose contents are presevered even if the battery voltage is cut off. This memory also has the task of preserving the fault codes to be read later using the diagnostic equipment.




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1. Electronic control unit
2. Electro-hydraulic control unit



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The wheel speed signals are sent by the active sensors to the electronic control unit.
The frequency of these signals provides the controlunit with the corresponding speed, acceleration or deceleration values for the individual wheels.
A reference speed is processed from the combination of the individual peripheral wheel speeds which, being constantly updated, indicates the speed of the vehicle at any moment.
When the driver presses the brake pedal the wheels may decelerate in differing degrees: by comparing the peripheral speed of the individual wheels with the reference speed it is possible to constantly control the creeping of each individual wheel.
If the braking force causes one wheel to creep in relation to the others (known in English as *split*), the electronic control unit gives the command to the electro-hydraulic control unit solenoid valves to reduce the braking force at the wheel where there is a loss of grip. The wheel concerned then regains speed.

**NOTE** *The peripheral speed of a braking wheel decreases to a greater extent than that of the vehicle, with the wheels completely locked through the braking action (peripheral speed of the wheel = 0) and the vehicle still moving the difference between these two speeds is at the maximum value.*
*This difference is known as creeping or the slipping coefficient when expressed as a percentage.*
*Creeping 0% = free wheel*
*Creeping 100% = wheel locked and vehicle moving*
*During braking the friction coefficient tends to increase when the braking takes place with limited creeping (rolling) and decrease when the sliding of the tyre is accentuated until it locks.*
*By means of a considerable number of practical tests and experiments it has been proven that, generally, it is possible to reach the maximum braking force with creeping values of between 10% and 20%. This defines an optimum area within which the anti-lock brakes operate for all types of vehicles.*

The electronic control unit also contains deceleration and acceleration threshold figures in its memory which each individual wheel should never exceed.
Therefore, by means of a systematic, continuous and extremely rapid comparison of the wheel slipping, deceleration and acceleration values the rolling of the tyre during braking is kept in check.

As soon as the acceleration/deceleration and combined *split* threshold values are exceeded, the electronic control unit intervenes, operating the electro-hydraulic control unit solenoid valves in the three regulation stages to decrease, maintain or restore the pressure created by the driver on the brake pedal to the brake calipers, restoring the braking conditions to the optimum values for the system.

These stages determine an intermittent, but extremely fast adjustment cycle which is repeated until the vehicle stops. The electronic control unit controls the various stages, supplying the solenoid valves with impulses of variable lengths. It is also ensures that both the rear wheels receive the same braking force applied to the rear wheel most likely to lock, i.e. the one with less adhesion (to ensure optimum trajectory stability).

The A.B.S. system is also activated when braking in reverse gear.
Usually, the intervention of the device ceases at speeds below 5 kph to allow the wheels to lock completely with the vehicle stationary.
Since the parameters which the control unit controls (wheel speed and acceleration) are affected by the inertia of the wheel/tyre assembly, vehicles equipped with anti-lock brakes **should only be fitted with the wheel rims, tyres and brake pads recommended by the Manufacturer.**

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If snow chains are fitted, the rolling condition gives rise to signals which are suitably filtered in the control unit and the anti-lock brakes are not excluded if driving over hard, compact snow.

In conditions where the grip conditions are poor and/or the engine torque is incorrect distributed (aquaplaning), the electronic control unit is informed through the rpm sensors on each wheel of an irregular condition whereby the driving wheels tend to rotate at a different speed from the driven wheels.

This condition involves switching the operation of the control unit in order to prevent the sensation of hardness during the operation of the brake pedal.

The electronic control unit has a safety circuit which has the task of safeguarding the efficiency of the system before every departure and whilst driving.
The safety circuit carries out the following self-checks:

1. after the ignition is switched on, for about 4 seconds it controls the operation of the control unit and the relays which operate the solenoid valves and the connection of the sensors;
2. after the engine is started up, as soon as 5 kph is exceeded, it activates the solenoid valves and the recovery pump for an operating check; it also checks the 4 wheel speed signals;
3. whilst driving it constantly compares the peripheral speed of the wheels with the reference speed calculated, it checks the memory conditions and constantly checks the battery voltage.

If one of these faults is detected, the anti-lock brakes, whilst still ensuring the normal operation of the conventional braking system, switch off and signal this condition to the driver through the failure warning light in the instrument panel coming on.

The electronic control unit is informed that the driver is braking by the signal arriving from the switch on the brake pedal. This information is useful in the case of strong deceleration, which causes the wheels to slip, followed by strong braking or in the case of uneven road surfaces (undulating, cobblestones) which could cause variations in the speed of the wheels for reasons not connected with the braking in progress.
Under these circumstances the microprocessors process a strategy linked to the variations in the speed of the wheels at these particular moments, restoring the braking in progress to within the correct parameters. Since these are particular braking conditions, a faulty connection of the switch on the brake pedal with the control unit will not adeversely affect the operation of the system. For this reason it is not signalled by the warning light coming on, neither is the A.B.S. system disabled.

**Electro-hydraulic control unit**

The electro-hydraulic control unit is connected to the brake pump and to the brake caliper cylinders by means of the braking system pipes.

Its task is to vary the pressure of the brake fluid in the brake caliper cylinders corresponding to the signals coming from the electronic control unit.

It is made up of eight two-way solenoid valves (two for each hydraulic circuit) and a twin circuit electric recovery pump.



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The eight solenoid valves and the electric recovery pump are operated by the electronic control unit according to the signals from the four rpm sensors. In particular, the pump allows the recovery of brake fluid during the pressure reduction stage making it available once again upstream of the solenoid valves for the subsequent pressure increase stage.
The low pressure accumulators make it possible to absorb brake fluid during the pressure reduction stage.

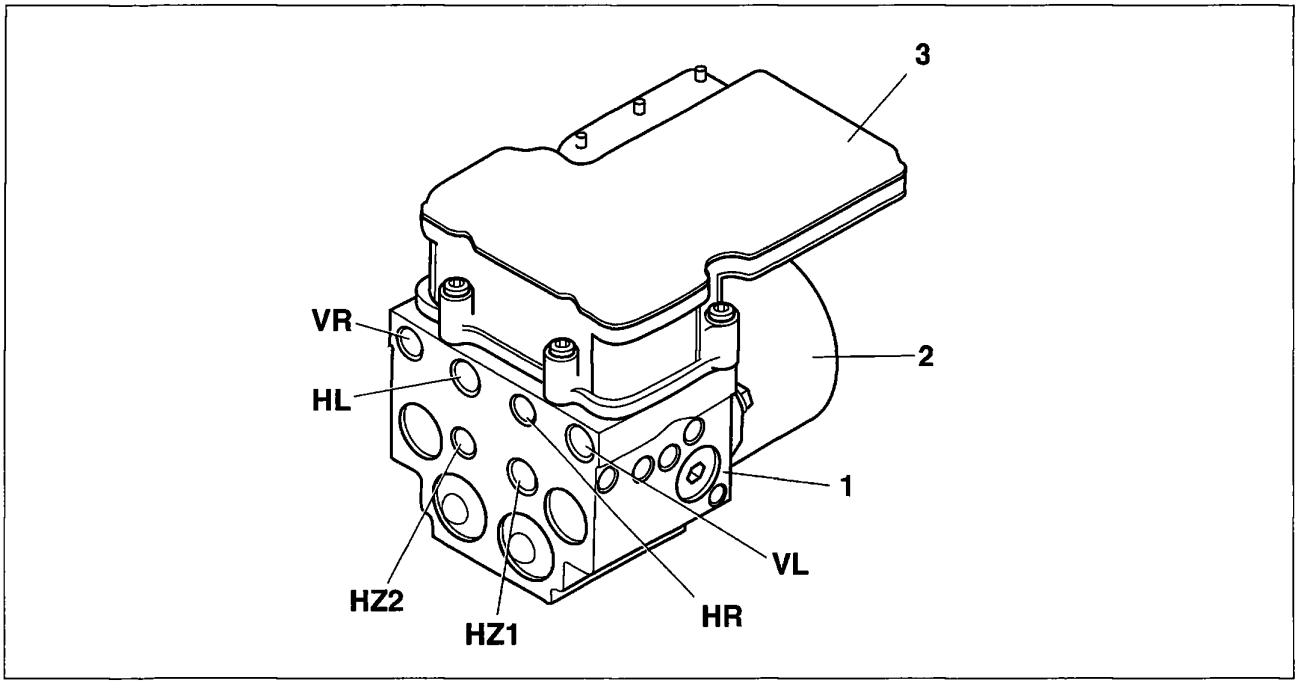
The unit is connected to the braking system by means of connectors which can be identified by the codes stamped on them as illustrated in the diagrams.

The electro-hydraulic control unit cannot be overhauled and should not be tampered with.
If a fault is confirmed, it should be replaced.

It is available as spares filled with brake fluid and with the solenoid valves not supplied.

The operation of bleeding and refilling the braking system is the same as for conventional systems.

**NOTE** *To avoid errors when connecting the various braking system circuits during repair operations, the electro-hydraulic unit connections are different sizes (M10x1 and M12x1) and also the connectors can be identified by the codes on them as illustrated in the diagram.*




P4F05BD01

***Identification of electro-hydraulic control unit outlets***

HZ1. Supply connector from brake pump M12x1 (primary circuit)
HZ2. Supply connector from brake pump M10x1 (secondary circuit)
VL. Supply connector to the left front brake caliper M12x1
HL. Supply connector to left rear brake caliper M12x1
VR. Supply connector to the right front brake caliper M10x1
HR. Supply connector to right rear brake caliper M10x1

1. Electro-hydraulic control unit
2. Electric recovery pump
3. Electronic control unit



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# 33.

## WHEEL RPM SENSORS (ACTIVE)

The operation of the "active sensors" is based on the variation of the internal electrical resistance depending on the intensity and the direction of the lines of force of an external magnetic field producing a square wave signal whose frequency varies according to the rotation speed of the wheel, but whose amplitude is constant.

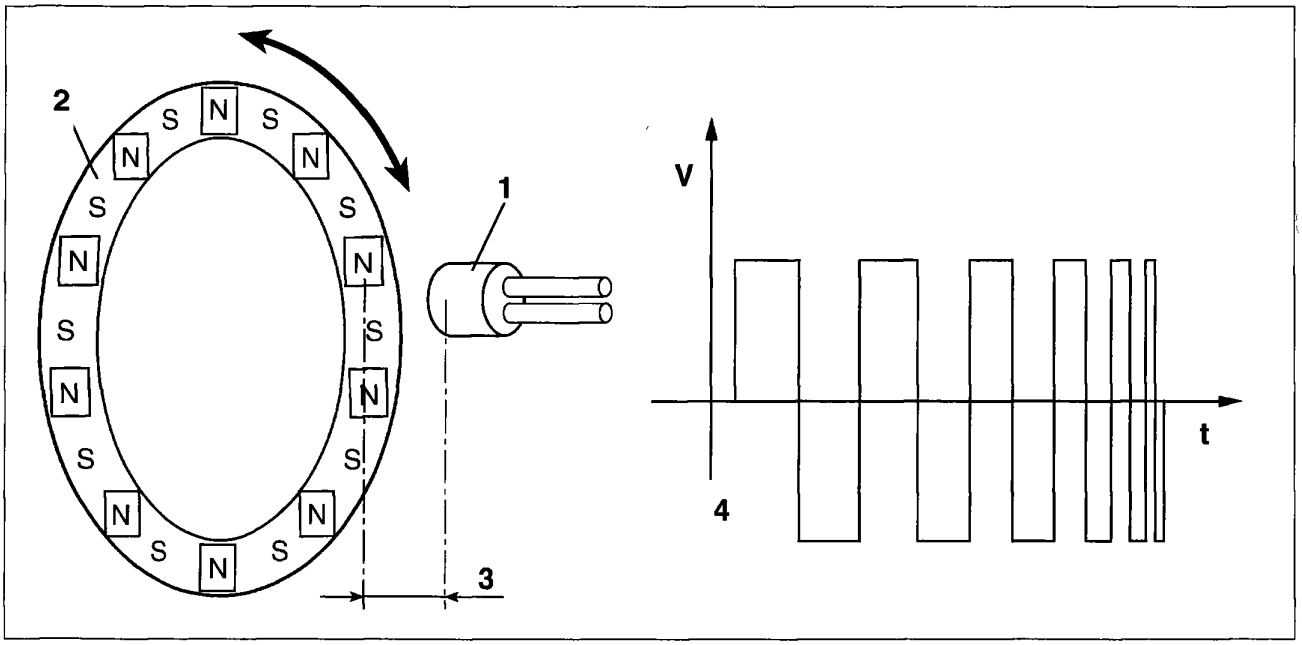
The external magnetic field is produced by a so-called "multi-polar ring" made up of an elastomer with a certain quantity of magnetic particles which, through a particular magnetization technique, are directed to create different magents with alternating North - South polarities around the circumference.

The multi-polar ring can be fitted on the wheel bearing seal or on the hub (rear wheels).

The sensor is supplied by the ABS electronic control unit and produces a square wave signal with an almost constant amplitude and a frequency proportional to the wheel rotation speed.

The use of this new type of sensor offers the following advantages compared with traditional magnetic induction sensors:

- less sensitivity to the distance between the sensor and the magnetic ring;
- improved immunity to electro-magnetic fields;
- the capacity of the sensor to measure the speed of the wheel up to zero (rather than 2.5 kph for the passive sensor);
- the reduction in weight and size in the vehicle.




P4F068D01

1. Active sensor casing
2. Multi-polar ring
3. Gap
4. Exampleof wheel rpm sensor output signal



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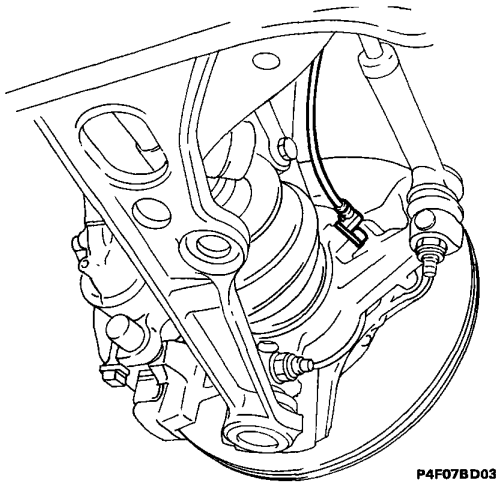
The recommended distance (gap), to obtain the correct signals, between the end of the sensor and the multi-polar ring should be between:

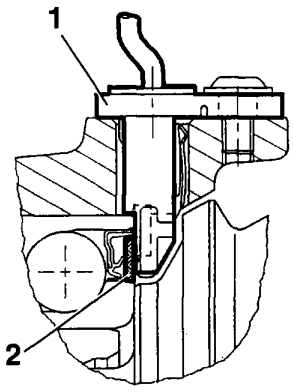
**0,17 ÷ 2,02 mm for the front wheels**
**0,57 ÷ 1,53 mm for the rear wheels**

This distance cannot be adjusted, therefore if the gap is outside of the tolerance, check the condition of the sensor and the multi-polar ring.

**NOTE** *Each time an rpm sensor is fitted, it should be lubricated with water-repellant grease to prevent the effects of thermal variations making it difficult to remove over a period of time.*

**Positioning of front wheel sensor**

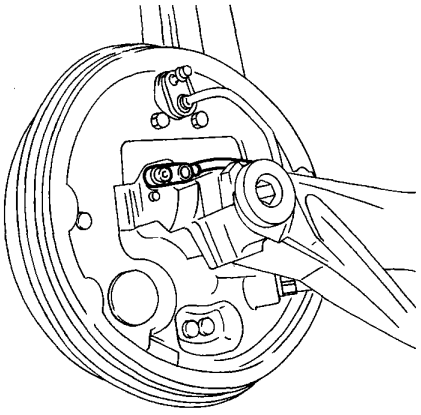

P4F07BD03



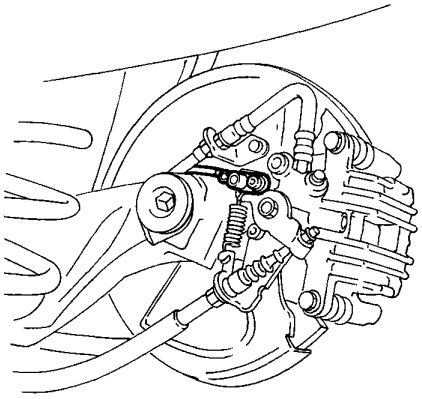
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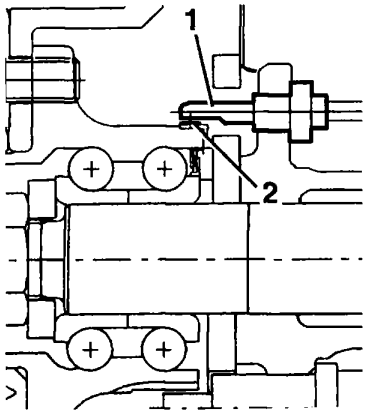
**Positioning of rear wheel sensor**

Version with drum


P4F07BD04

Version with disc


P4F07BD05



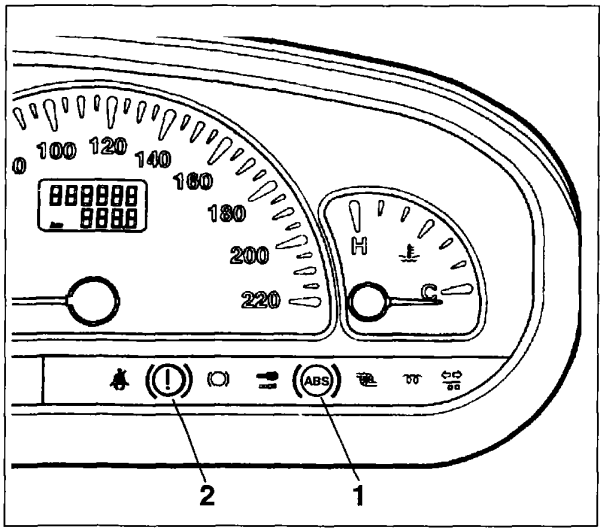
P4F07BD02

1. Active sensor
2. Multi-polar ring



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### Warning light signalling A.B.S. failure




P4F08BD01

1. ABS warning light
2. Braking system failure warning light

With the ignition switch in the ON position, the control unit carries out a static self-control cycle during which the warning lights (1 and 2) come on.

After about 2 seconds (if the control system does not detect any faults), the warning lights go out.

If the warning light (1) remains on, this means that there is a fault in one or more of the A.B.S. system components. Under these circumstances, the A.B.S. system is disabled but the EBA system continues to operate, therefore the braking force continues to be distributed like on a conventional braking system.

If the warning light (1) does not come on, (with the ignition switched on) then the cause of the problem should be sought in the LED of the actual warning light or in the electrical connection.

At around 6 kph the A.B.S. system is switched on.

When driving at a speed of about 6 kph, the system test cycle starts to operate. If the system component responses are positive, then the warning light remains switched off. If the response is negative, then the warning light comes on and the A.B.S. system is automatically deactivated. Braking takes place conventionally.

When the battery is not fully charged, the warning light may come on and the A.B.S. is excluded such as, for example, in town when driving at very low speeds with all the consumers switched on.

### EBA function failure signal

A failure of the EBA function is signalled by the ABS warning light coming on at the same time as the braking system failure warning light (2) in the instrument panel.

The warning light (2) in the instrument panel coming on not accompanied by the ABS warning light (1) coming on does not indicate a malfunction of the EBA, but one of the other faults signalled (low brake fluid level, handbrake applied).

If there is a fault in the EBA, the distribution of the brake force between the front and rear axles tends to fail with the consequent risk of the rear wheels locking during braking in certain conditions.



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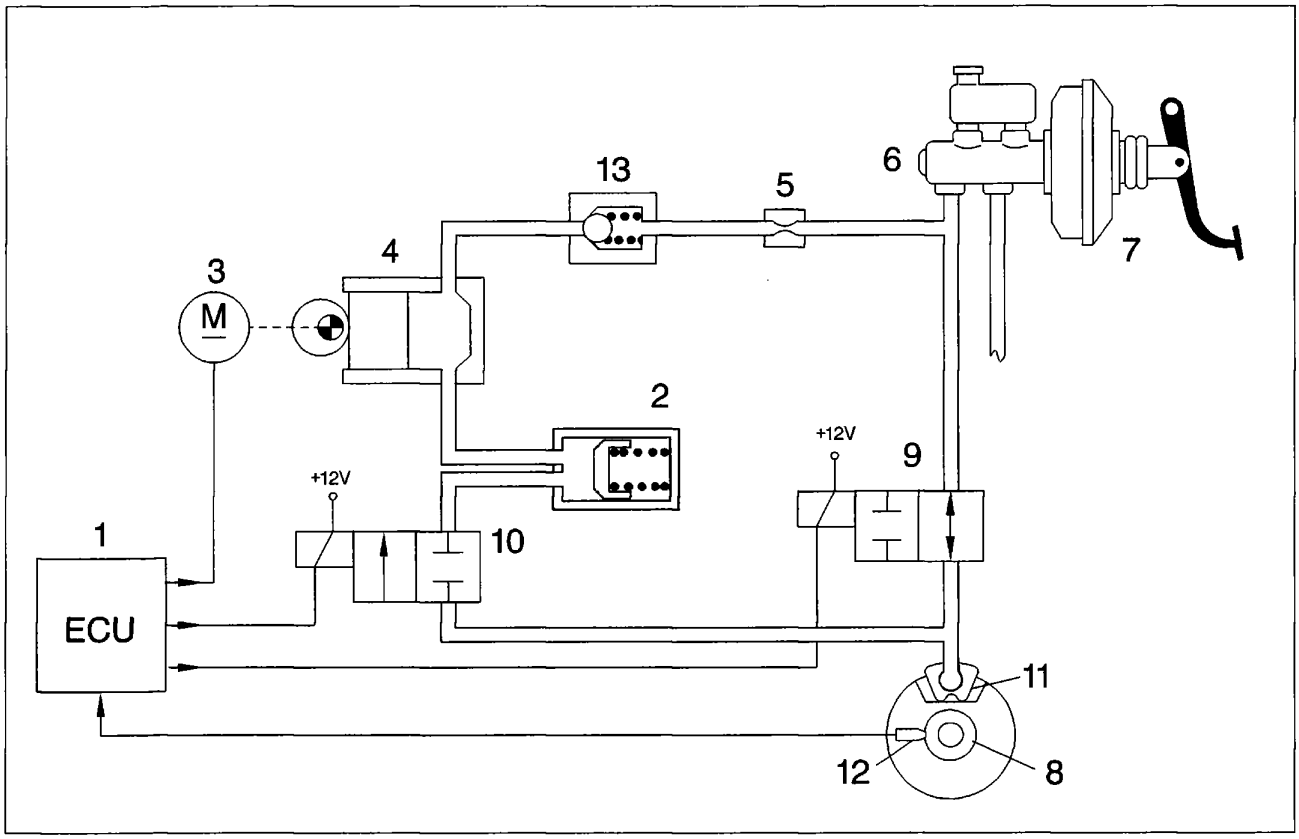
## DESCRIPTION OF THE OPERATION OF THE ANTI-LOCK BRAKES

### Rest position

Each branch of the ABS EBC 430 system hydraulic circuit is equipped with two two-way solenoid valves; all the solenoid valves are managed by the control unit (1).

When the pressurizing solenoid valve (9) is deactivated (not connected to earth by the control unit) it is in an open position, allowing the flow of fluid to the brake caliper.

The pressure maintenance is achieved by closing this valve, i.e. supplying it electrically.




P4F09BD01

1. Electronic control unit
2. Low pressure accumulator (reservoir)
3. Recovery pump motor
4. Recovery pump
5. Restricter
6. Brake pump
7. Brake servo
8. Multi-polar ring
9. Pressurizing solenoid valve
10. Discharging solenoid valve
11. Brake caliper
12. Rpm sensor
13. Single-acting valve

When it is deactivated, the discharging solenoid valve (10) (not connected to earth by the control unit) is in the closed position and does not allow the fluid to be discharged at the low pressure accumulator (2).

The accumulators (2) have the task of temporarily storing the brake fluid which is available during the pressure reduction stage.

The recovery pump (4) sends the brake fluid which flows from the brake calipers, during the pressure reduction stage, to the brake pump through the restricter (5), which has the task of damping the pressure and the impulses generated by the pump perceived by the driver.

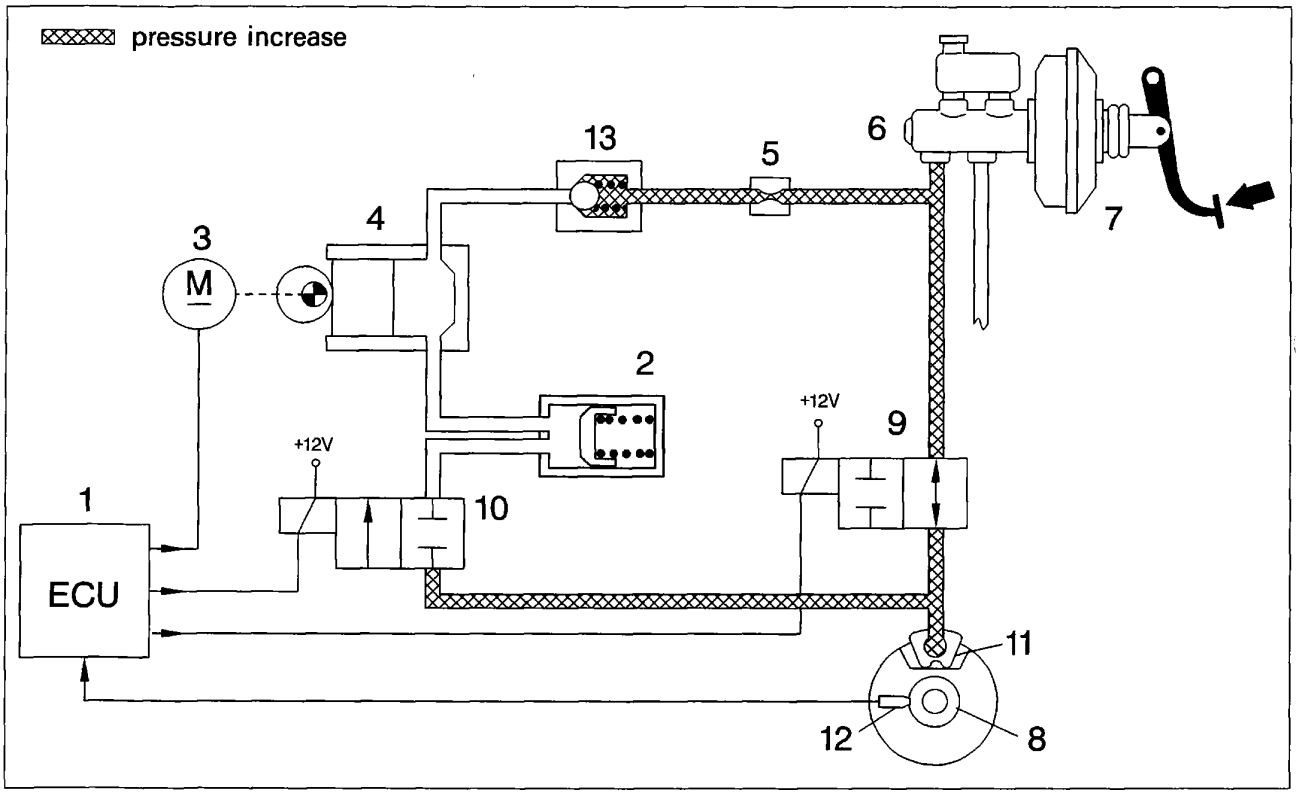
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# 33.

On the basis of the signals received from the rpm sensors on the front and rear wheels, the electronic control unit operates the electro-hydraulic control unit which, in turn, varies the pressure of the brake fluid sent to the calipers in accordance with three stages: pressure increase, maintenance or decrease.

**Pressure increase stage**




1. Electronic control unit
2. Low pressure accumulator (reservoir)
3. Recovery pump motor
4. Recovery pump
5. Restricter
6. Brake pump
7. Brake servo
8. Multi-polar ring
9. Pressurizing solenoid valve
10. Discharging solenoid valve
11. Brake caliper
12. Rpm sensor
13. Single-acting valve

When the driver presses the brake pedal, the pressure produced by the brake pump (6) reaches the brake caliper without undergoing variations, because the solenoid valves (9) and (10) for the hydraulic unit are not connected to earth by the electronic control unit.

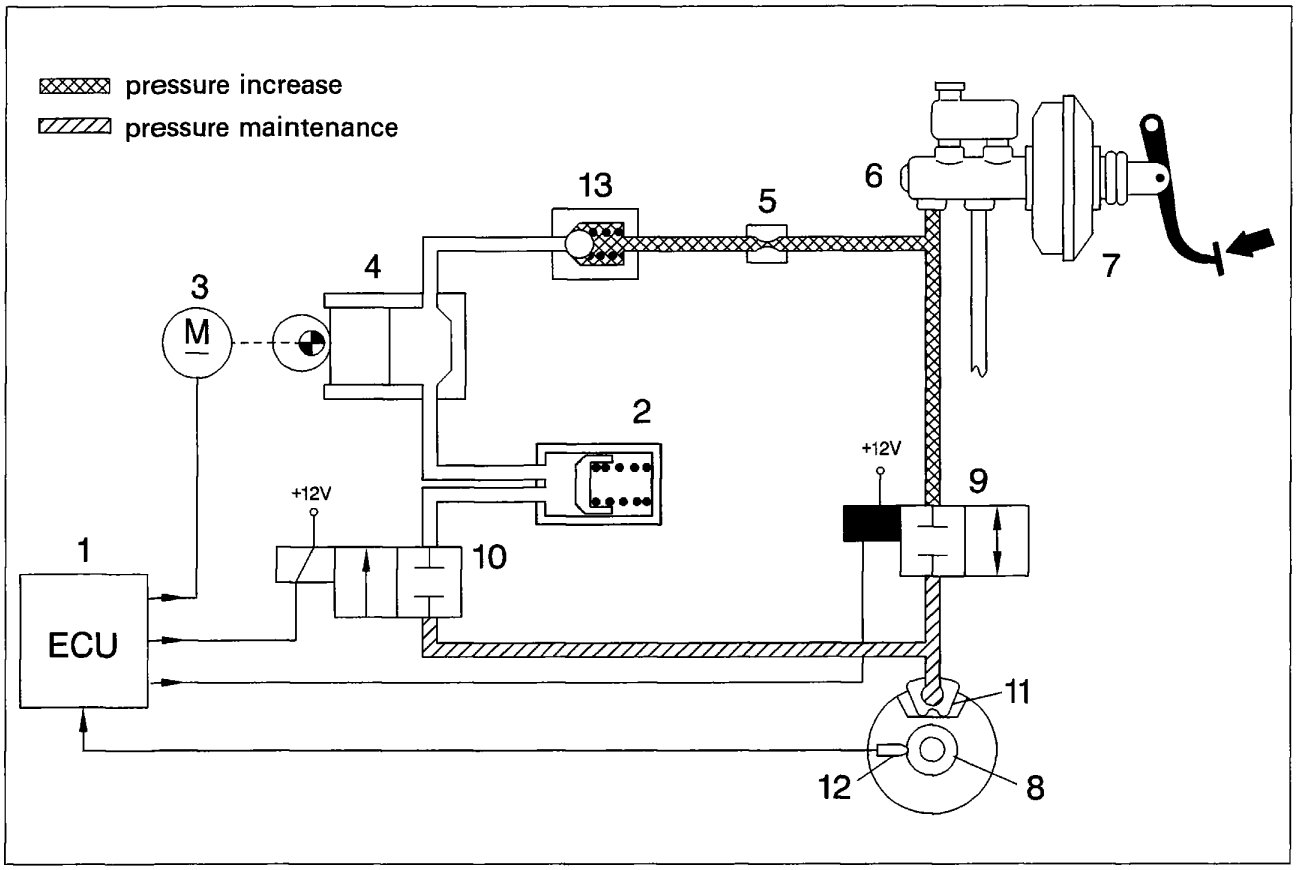
When the braking force increases, the deceleration of the wheel consequently increases: this causes a faster deceleration of the vehicle (i.e. the slipping of the wheel increases).
The value of the creeping should not exceed a given figure beyond which the wheel loses its grip with the ground and starts to slip, losing direction and increasing the braking distances.

The rpm sensor (12) signals that the deceleration values reached could adversely affect the adhesion of the wheel to the ground: at this point the electronic control unit (1) commands the electro-hydraulic unit solenoid valves, reducing the braking force and allowing the speed of the wheel to increase to recover its grip.



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**Pressure maintenance stage**




1. Electronic control unit
2. Low pressure accumulator (reservoir)
3. Recovery pump motor
4. Recovery pump
5. Restricter
6. Brake pump
7. Brake servo
8. Multi-polar ring
9. Pressurizing solenoid valve
10. Discharging solenoid valve
11. Brake caliper
12. Rpm sensor

During this stage the electronic control unit (1) connects the pressurizing solenoid valve (9) to earth which closes, whilst the discharing solenoid valve (10) is already closed as it is not connected to earth.

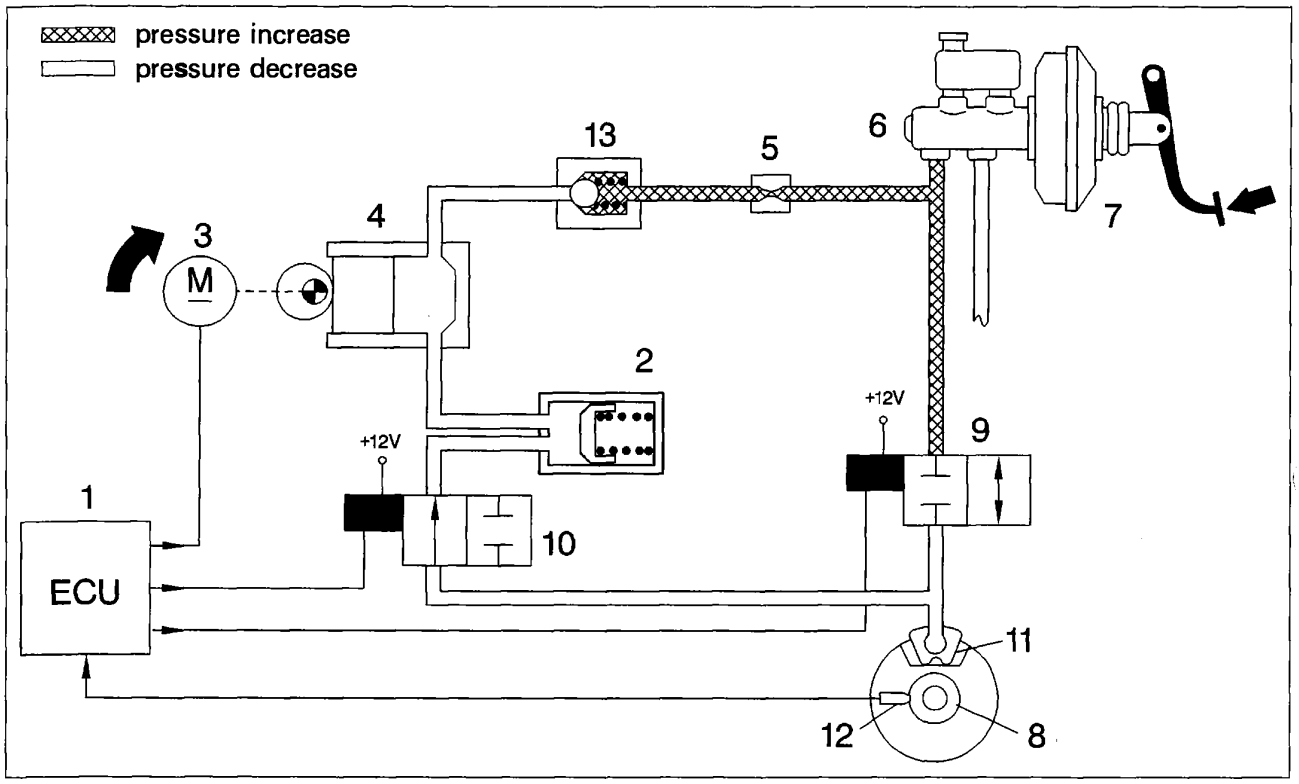
The hydraulic connection between the brake pump (6) and the brake caliper (11) in interrupted (waiting position).
The pressure in the brake caliper (11) is kept constant at the value reached previously, even if the pressure on the brake pedal is increased.

In spite of this the braking force maintains a constant slowing down action, the speed of the wheel varies, according to the adhesion on the ground, until the rpm sensor (12) signal detects a value which is comparable to the reference speed calculated by the electronic control unit (1).
At this point the control unit moves on from the pressure maintenance stage to the increase stage (if the wheel is accelerating) or to the decrease stage (if the wheel tends to lock).

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**Pressure reduction stage**




1. Electronic control unit
2. Low pressure accumulator (reservoir)
3. Recovery pump motor
4. Recovery pump
5. Restricter
6. Brake pump
7. Brake servo
8. Multi-polar ring
9. Pressurizing solenoid valve
10. Discharging solenoid valve
11. Brake caliper
12. Rpm sensor
13. Single-acting valve

The electronic control unit (1) detects the tendency of the wheel to lock and alerts the electro-hydraulic unit to contain the deceleration of the wheel within the permissible limits.

The electronic control unit (1) connects the pressurizing (9) and discharging (10) solenoid valves to earth.
The pressurizing solenoid valve (9) remains closed keeping the connection between the brake pump (6) and the brake caliper (11) interrupted; the discharging solenoid valve (10) opens making a hydraulic connection between the brake caliper (11) and the low pressure accumulator (2) and the recovery pump (4), in such a way as to remove some of the fluid from the brake caliper (11) and decrease the pressure at the actual caliper.
At the same time, the electronic control unit (1) supplies the recover pump (4) motor (3) which allows the fluid removed from the brake caliper (11) to be reintroduced into the main circuit.
The low pressure reservoir or accumulator (2) in the circuit has the task of storing part of the brake fluid removed from the calipers. The fluid is drawn in through the recovery pump (4) circuit and sent, by means of the restricter (5), into the brake pump (6) main circuit.
During this stage a series of pressure waves (or hydraulic thrusts) are produced which notify the driver that the ABS device has started to work.

During braking, slight force on the brake pedal should be considered normal during the intervention of the A.B.S. system, During this stage, as a result of the decreased braking force, the wheel tends to return to the reference speed calculated by the electronic control unit (1).

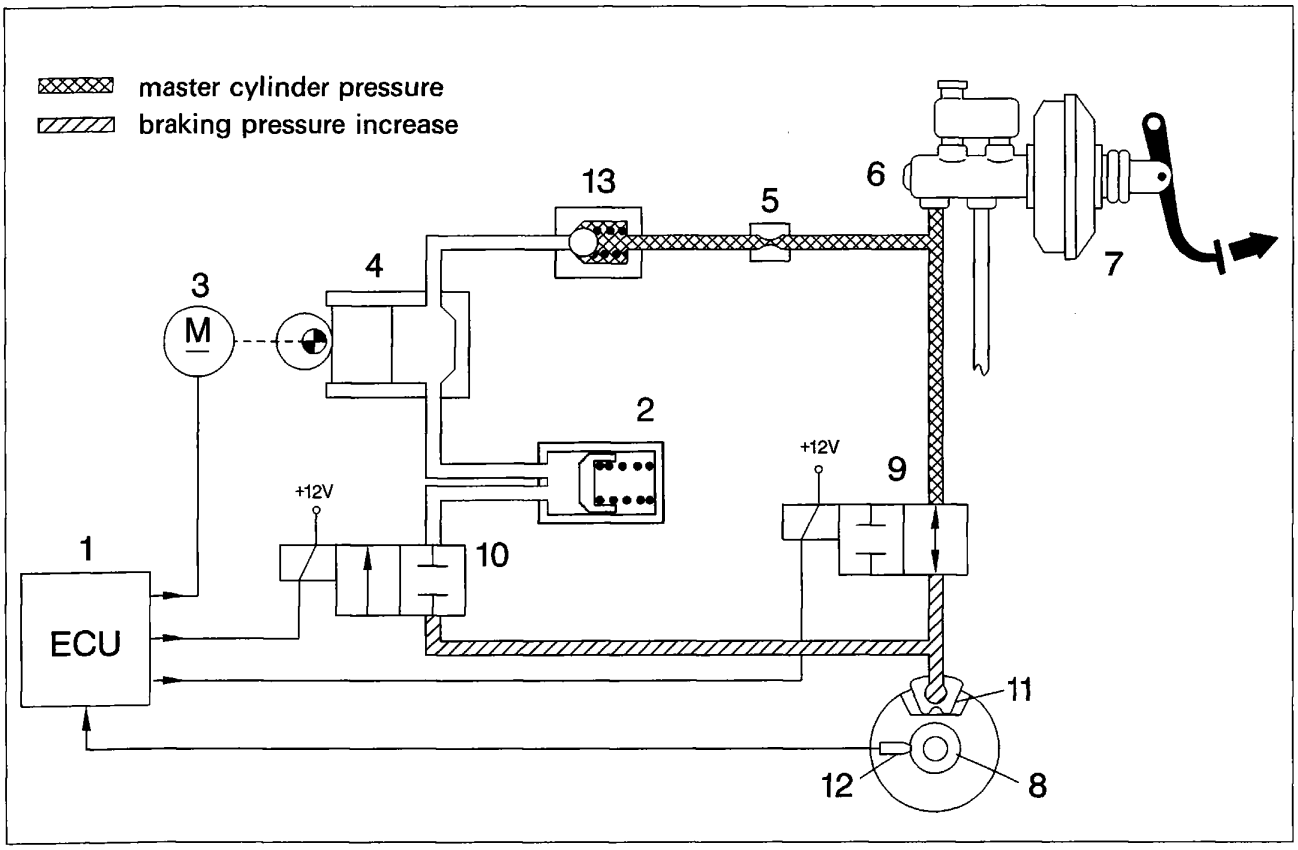


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The ABS stops working at speeds below 5 kph to allow the wheels to lock completely with the vehicle stationary.

**Pressure increase stage**

When the tendency to slip is over, the discharging solenoid valve (10) closes. The system enters the pressure increase stage for the brake caliper (11); this is achieved through a rapid opening and closing sequence of the pressurizing valve (9). When the electronic control unit (1) once again detects creeping conditions, it activates the strategy described in the "Pressure reduction stage" paragraph.



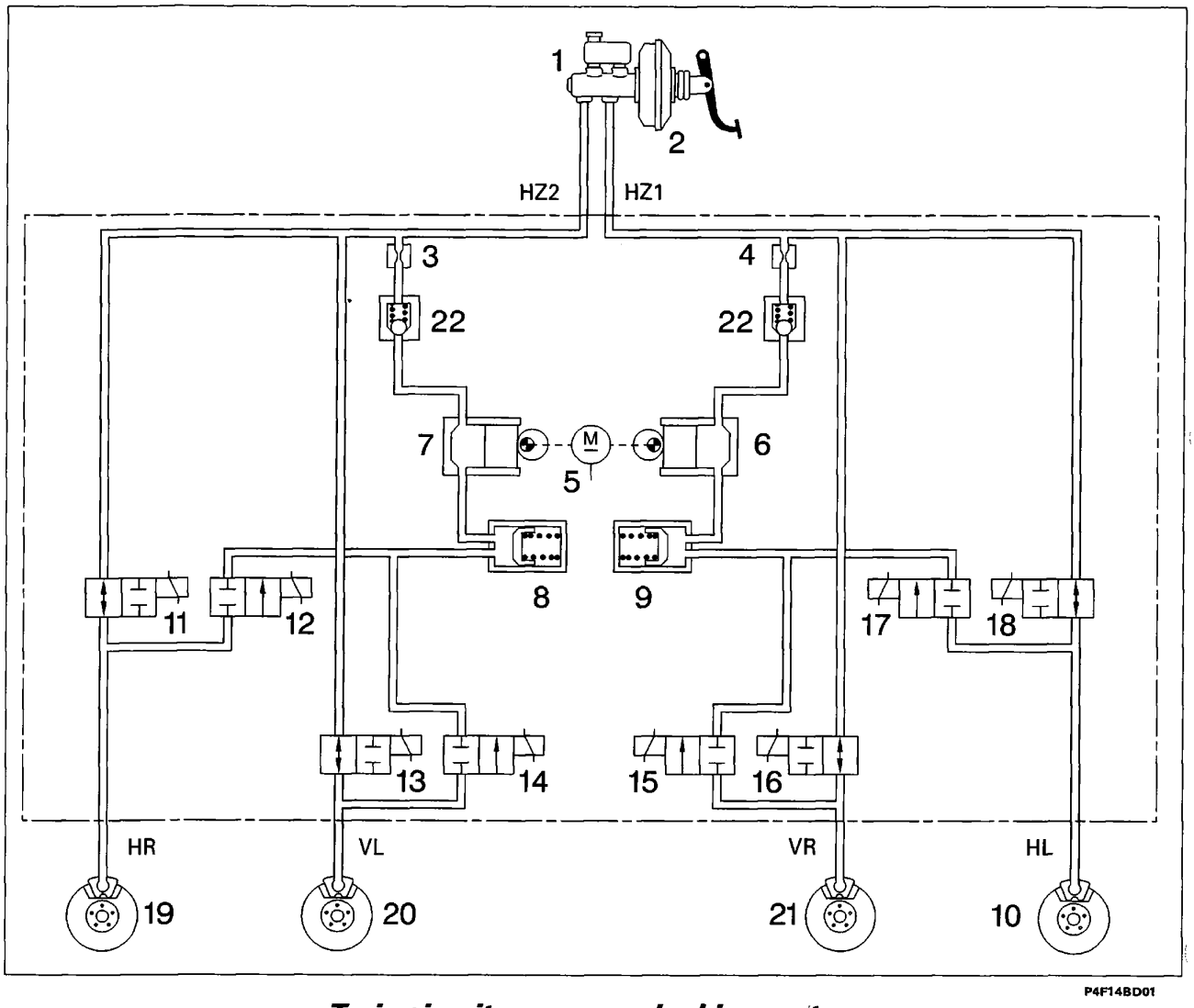

P4F13BD01

1. Electronic control unit
2. Low pressure accumulator (reservoir)
3. Recovery pump motor
4. Recovery pump
5. Restricter
6. Brake pump
7. Brake servo
8. Multi-polar ring
9. Pressurizing solenoid valve
10. Discharging solenoid valve
11. Brake caliper
12. Rpm sensor
13. Single-acting valve

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### DIAGRAM SHOWING A.B.S. HYDRAULIC SYSTEM




***Twin circuit cross-over braking system***

1. Brake pump
2. Brake servo
3. Restricter
4. Restricter
5. Recovery pump motors
6. Recovery pump
7. Recovery pump
8. Low pressure accumulator (reservoir)
9. Low pressure accumulator (reservoir)
10. Left rear disc (or drum) brake
11. Right rear pressurizing solenoid valve
12. Right rear discharging solenoid valve
13. Left front pressurizing solenoid valve
14. Left front discharging solenoid valve
15. Right front pressurizing solenoid valve
16. Right front discharging solenoid valve
17. Left rear pressurizing solenoid valve
18. Left rear discharging solenoid valve
19. Right rear disc (or drum) brake
20. Left front disc brake
21. Right front disc brake
22. Single-acting valve

HZ1. Supply connector 1st stage for brake pump
HZ2. Supply connector 2nd stage for brake pump

HR. Supply connector to the right rear caliper
VL. Supply connector to the left front caliper
VR. Supply connector to the right front caliper
HL. Supply connector to the left rear caliper




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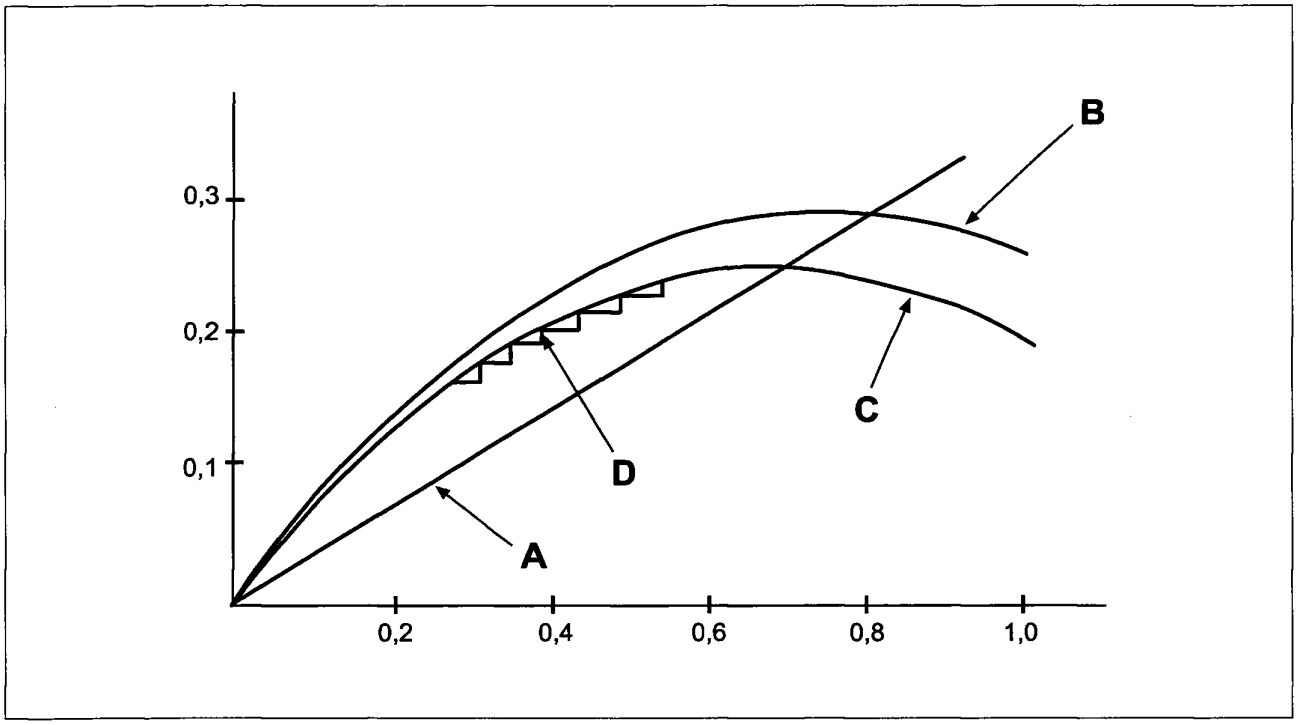
**EBA function (Electronic Brake Apportioning)**

The introduction of the EBC 430 makes it possible to distribute the brake force between the front and rear axles using a special function of the electronic control unit.

With this in mind, the electronic control unit continuously compares the speed of the front and rear wheels using the speed sensors and operates the electro-hydraulic unit in order to prevent the rear wheels from locking, always taking maximum advantage of the adhesion to the ground in all load conditions.

The EBA function makes the need for the hydraulic load proportioning valve acting according to the load on the rear axle superfluous which is why it has been eliminated from the vehicle braking circuit.

The graph below illustrates the intervention of the EBA device (curve D) in relation to the pressure in the braking system (curva A), the ideal pressure at the rear axle brakes (curve C), on the assumption that the vehicle is empty.




P4F15BD01

A. Distribution implemented by the braking system
B. Ideal distribution, with vehicle fully laden
C. Ideal distribution, with vehicle empty
D. EBA control

As it can be noted, the EBD function for the ABS system is capable of adapting to the ideal pressure curve, always exploiting the available adhesion in all braking conditions.

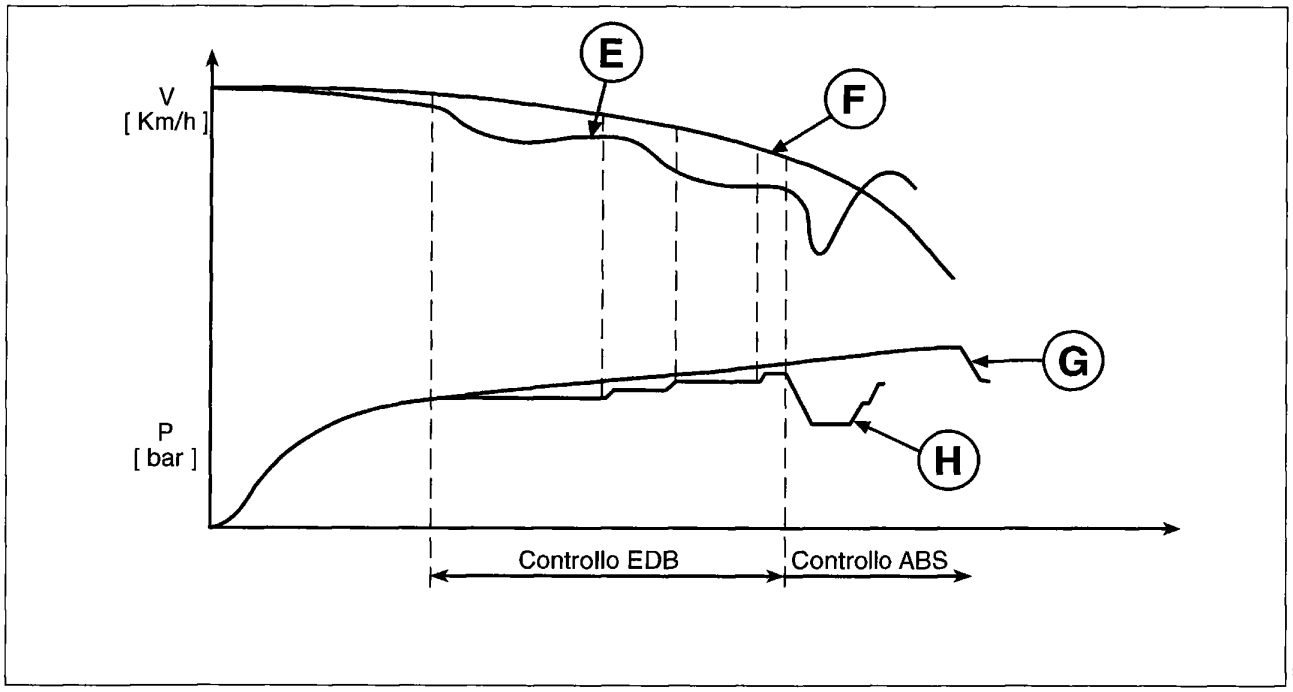


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# 33.

The integration of the EBA function in the regular ABS system logic gives the possibility of two simultaneous strategies; the system usually intervenes to keep the creeping of the rear wheels within values which are very close to the ideal figures, with the possibility, however, of intervening with the ABS strategy when one of the rear wheels tends to lock (for example when driving over a surface with poor adhesion).

The graph below illustrates the braking pressure implementation strategy, operated by the electronic control unit, on the basis of the input data, represented by the signal for the rotation speed of the wheels on the two axles.




E. Rear wheel speed

F. Front wheel speed

G. Front wheel pressure

H. Rear wheel pressure

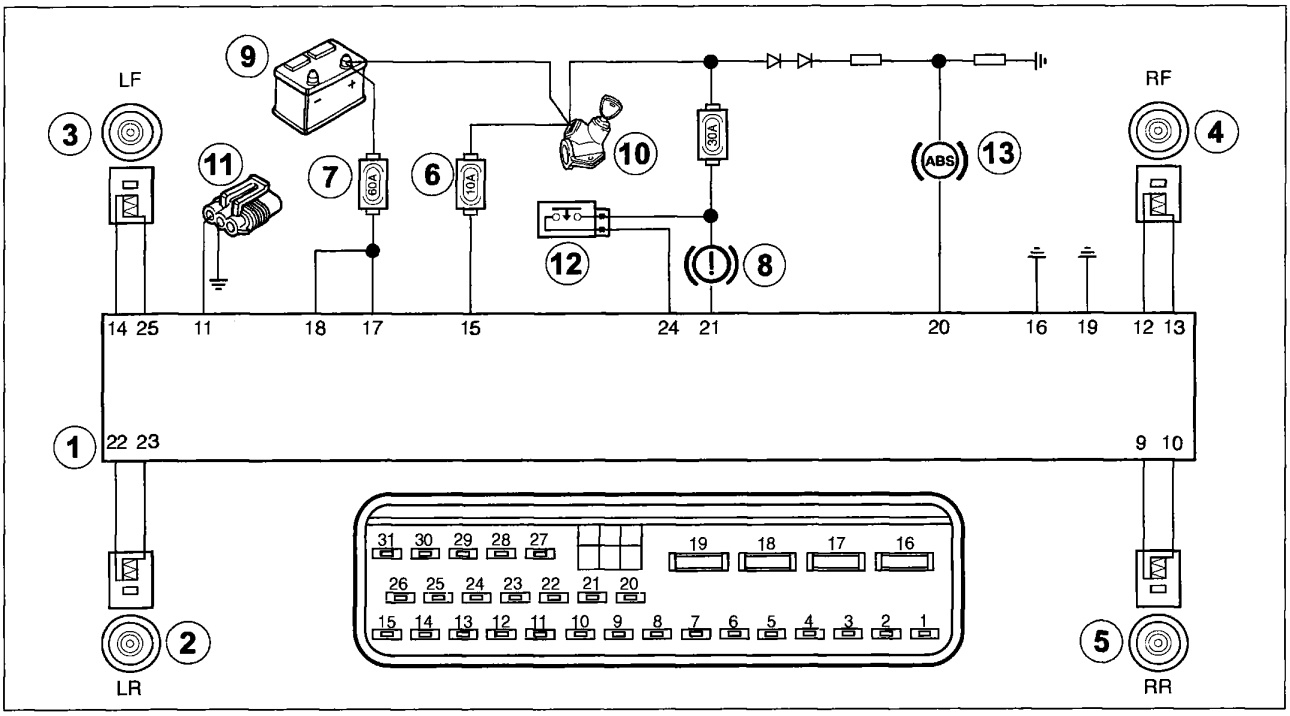
EBA OPERATION

The braking pressure of the wheels on the rear axle are checked by the control unit in the same way as described for the ABS operation in the "Pressure maintenance stage" and the "Pressure reduction stage", with the difference being that the electric recovery pump is not activated and any excess hydraulic fluid is recovered in the low pressure accumulator. The fluid returns to the supply circuit when the braking is over.



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## WIRING DIAGRAM FOR LUCAS VARITY EBC 430 SYSTEM




P4F17BD01

1. Electronic control unit
2. Left rear rpm sensor (RL)
3. Left front rpm sensor (FL)
4. Right front rpm sensor (FR)
5. Right rear rpm sensor (RR)
6. 10A protective fuse
7. 60A protective fuse
8. Braking system failure warning light (EBA)
9. Battery
10. Ignition switch
11. Diagnostic socket
12. Brake lights switch
13. A.B.S. warning light

### *Identification of terminals at electronic control unit and at connector*

| N° | Destination | N° | Destination |
|---|---|---|---|
| 1 | Spare | 17 | 60A fuse |
| 2 | Spare | 18 | 60A fuse |
| 3 | Spare | 19 | Earth |
| 4 | Spare | 20 | ABS warning light |
| 5 | Spare | 21 | EBA warning light |
| 6 | Spare | 22 | Left rear sensor |
| 7 | Spare | 23 | Left rear sensor |
| 8 | Spare | 24 | Brake lights switch |
| 9 | Right rear sensor | 25 | Left front sensor |
| 10 | Right rear sensor | 26 | Spare |
| 11 | Diagnostic line | 27 | Spare |
| 12 | Right front sensor | 28 | Spare |
| 13 | Right front sensor | 29 | Spare |
| 14 | Left front sensor | 30 | Spare |
| 15 | 10A fuse | 31 | Spare |
| 16 | Earth | | |

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CLIMATE CONTROL

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- Removing and refitting compressor 14

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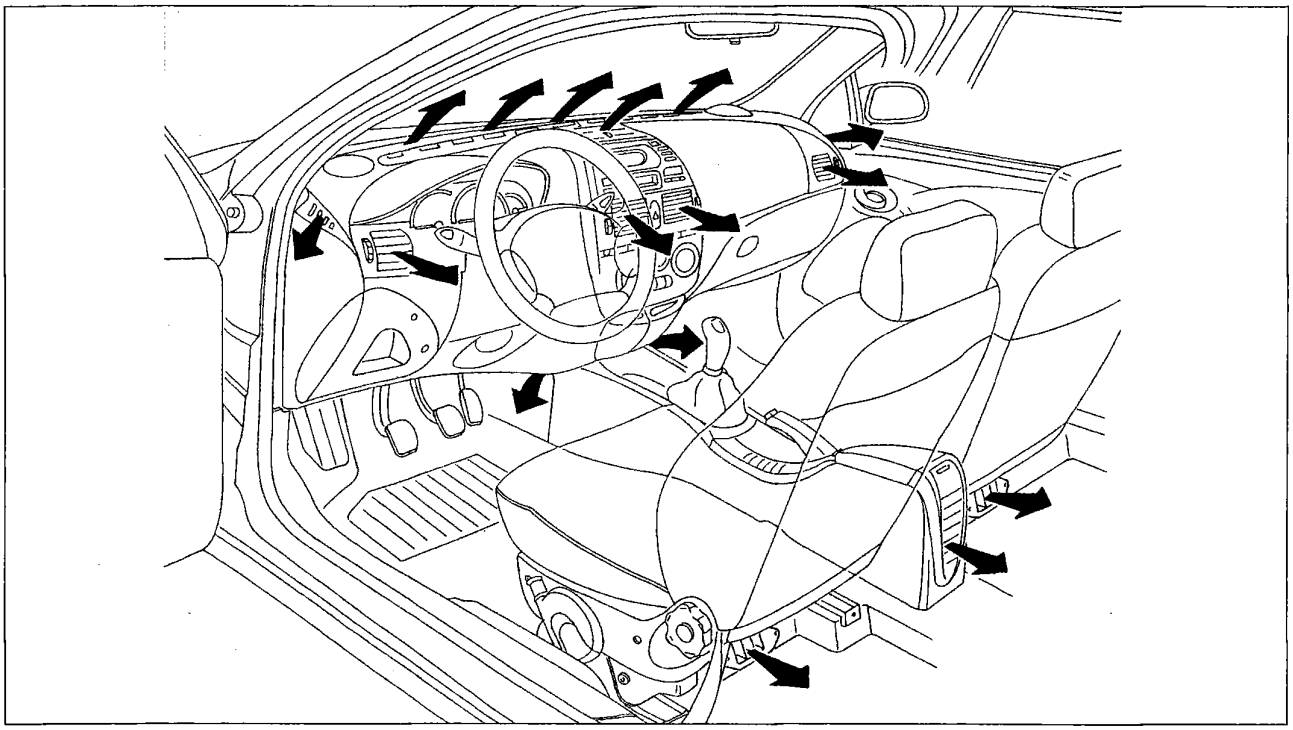
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## FOREWORD

The vehicle's climate control is carried out by one of the following systems:

- HEATER WITH THERMOSTATIC ADJUSTMENT
- AIR CONDITIONER WITH THERMOSTATIC ADJUSTMENT

The two systems are described below jointly because the only difference between the heater and the climate control system is that the former does not have an air refrigeration circuit: the electronic control unit which regulates the entire system is, in effect, the same and it recognizes whether or not there is a refrigeration circuit from the A/C button which is in the control panel of the version with climate control only.
For anything not dealt with on the pages which follow, refer to the descriptions in the – Marea – Marea Weekend Service Manual (print n°506.763/01).



4F01AH01

## CONNECTION WITH ENGINE MANAGEMENT CONTROL UNIT

The electronic control unit for the climate control system sends a signal to the engine management control unit giving the necessary go ahead to switch on the compressor.
There are two different type of connection according to the type of engine management control unit:
**A**: 1242 – 1581 – 1998 – 1910 JTD – 2387 JTD engines
**B**: 1910 TD 75 (Soft) engine

**NOTE** *For the 1747 version, refer to the instructions in the previous edition.*

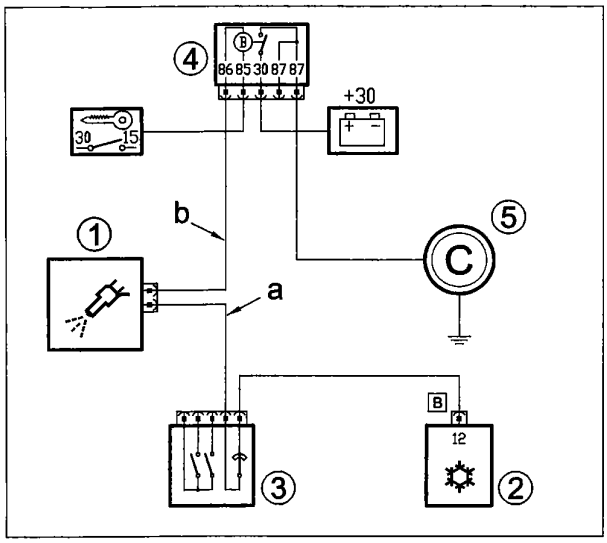
**NOTE** *For the 1910 TD 75 version, which does not have an engine management control unit, the go ahead for the operation of the compressor is given by a speical thermal switch and by the EGT control unit in addition to the four stage pressure switch.*



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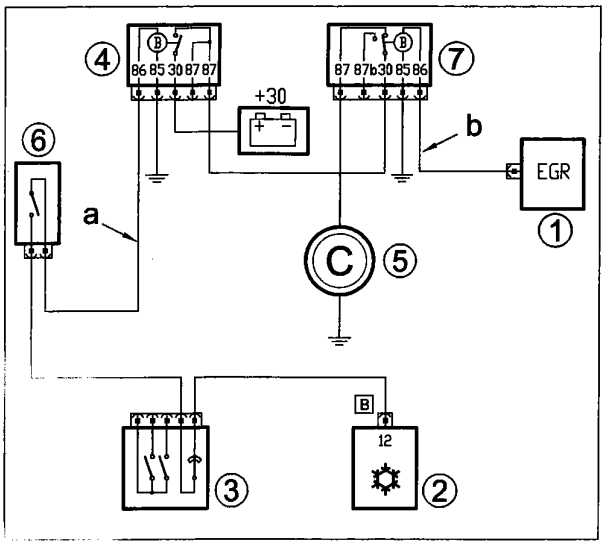
Case **A**: the engine management control unit (1) receives the signal for switching on the compressor (a) directly from the climate control unit (2) and the four stage pressure switch (3): if the pressure in the refrigerant circuit is not correct, this signal is interrupted. Lastly, if other particular exclusion conditions are not present (e.g. request for maximum power, idle speed, etc.), then the control unit (1) sends the command (b) to switch on the compressor (5) via the relay (4).




4F02DH01

**1242 – 1581 – 1998 – 1910 JTD – 2387 JTD Engines**
1. Injection control unit
2. Climate control unit
3. Four stage pressure switch
4. Compressor relay
5. Compresor

Case **B:** the signal (a) to switch on the compressor is sent, via the climate control unit (**2**) to the four stage pressure switch (3) and the thermostatic switch (6) and the compressor engagement relay (4). If the particular conditions for switching off the compressor (5) are present (e.g. request for maximum power, idle speed, etc.), then a signal (b), sent by the **EGR** control unti (**1**) to the remote control switch (**7**), switchs off the compressor.




4F02DH02

**1910 TD 75 (Soft) Engine**
1. **EGR** control unit
2. Climate control unit
3. Four stage pressure switch
4. Compressor relay
5. Compressor
6. Thermal switch on water pump
7. Compressor remote control off switch

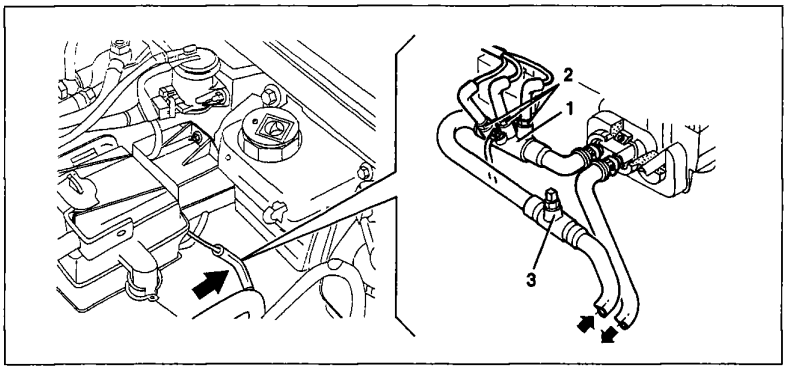


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## ADDITIONAL HEATER

The heating inside the vehicle by the heater unit is not sufficient when the engine is cold, especially for diesel engines which take longer to reach their operating temperature. An additional heating system is available on these versions which is activated when the engine is first running and is operational until it reaches a certain temperature.
The system consists of an additional heating device, located on the coolant supply pipe from the engine to the heater unit.
This device contains three heater plugs, very similar to those used for pre-heating the combustion chambers.

### Location of coolant heater plugs inside the vehicle




4F03DH01

1. Additional heater
2. Heater plugs
3. Temperature sensor

The additional heater (1), which contains the three heater plugs (2), is located on the coolant supply pipe to the heater unit.
The coolant temperature sensor (3) is fitted on the same pipe, immediately upstream towards the engine thermostat.
The three relays are connected near the diesel filter, on a special bracket fastened to the engine compartment bulkhead.
The system control unit is located under the dashboard, behind the glove compartment.

### Operating logic

The operation of the heater plugs is controlled by an electronic control unit which operates either one, two or all three of them providing a power output of 200W, 400W or 600W.

This control logic depends on:
- the temperature reached by the coolant as it leaves the engine;
- the level of power available;
- the engine rpm.

The first information is supplied by a special temperature sensor located on the supply pipe to the heater; the control logic deactivates the heater plugs when the temperature of the coolant coming from the engine exceeds 70°C.
The control unit also takes into account the parameter of the temperature of the air in the engine compartment: it is not meaured by a special sensor, but a theoretical value is taken equal to that of the coolant when starting; the switching off value goes down to from 70°C to 65°C if the theoretical temperature of the air is higher.



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The second piece of information is the electric power level available and this is obtained from the battery voltage; if the voltage is higher than 12.8 V then the operation of the heater plugs is enabled and below this value either one, two or all three of the heater plugs are gradually deactivated.

This parameter is checked every 10 seconds in order to always keep the power absorbed under control so that the battery does not get run down.

The information concerning the engine speed is used to prevent the operation of the heater plugs when the engine is not running, the enablement figure is about 660 rpm.

Either one, two or all three heater plugs are operated by two relays:

1st level activated by the first relay.
2nd level activated by the second relay.
3rd level activated by both relays.

There is a third relay/safety switch which interrupts the supply to the heater plugs if the earth contact is not correct; the metal device containing the heater plugs is, in effect, connected to the engine earth via a special cable loom, if this connection is interrupted, the relay stops the current supply to the heater plugs.



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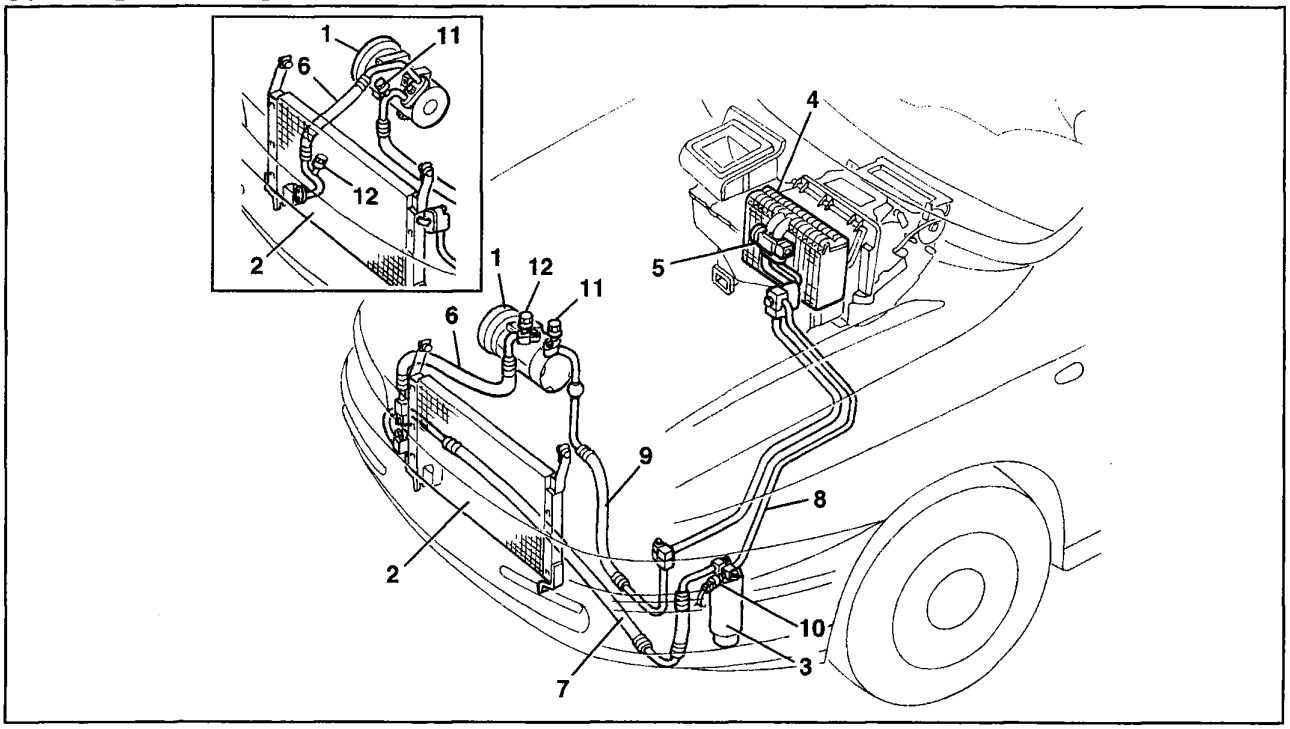
## LOCATION OF CLIMATE CONTROL SYSTEM COMPONENTS

The climate control system consists of the following components:

- a variable capacity compressor which is fastened to the engine by brackets;
- a condenser which is a heat exchanger, fitted in front of the engine coolant radiator;
- a drier filter located on the left side of the condenser;
- an evaporator which is the second heat exchanger for the system, located in the above mentioned assembly;
- an expansion valve which is fitted on the evaporator inlet duct;
- various rigid and flexible pipes which connect the various system components;
- a four stage pressure switch fitted on the drier filter.

There are two small pipes on the high and low pressure pipes to which a needle valve, designed for draining and re-pressurizing the system, is fitted.

### JTD ENGINE TYPES




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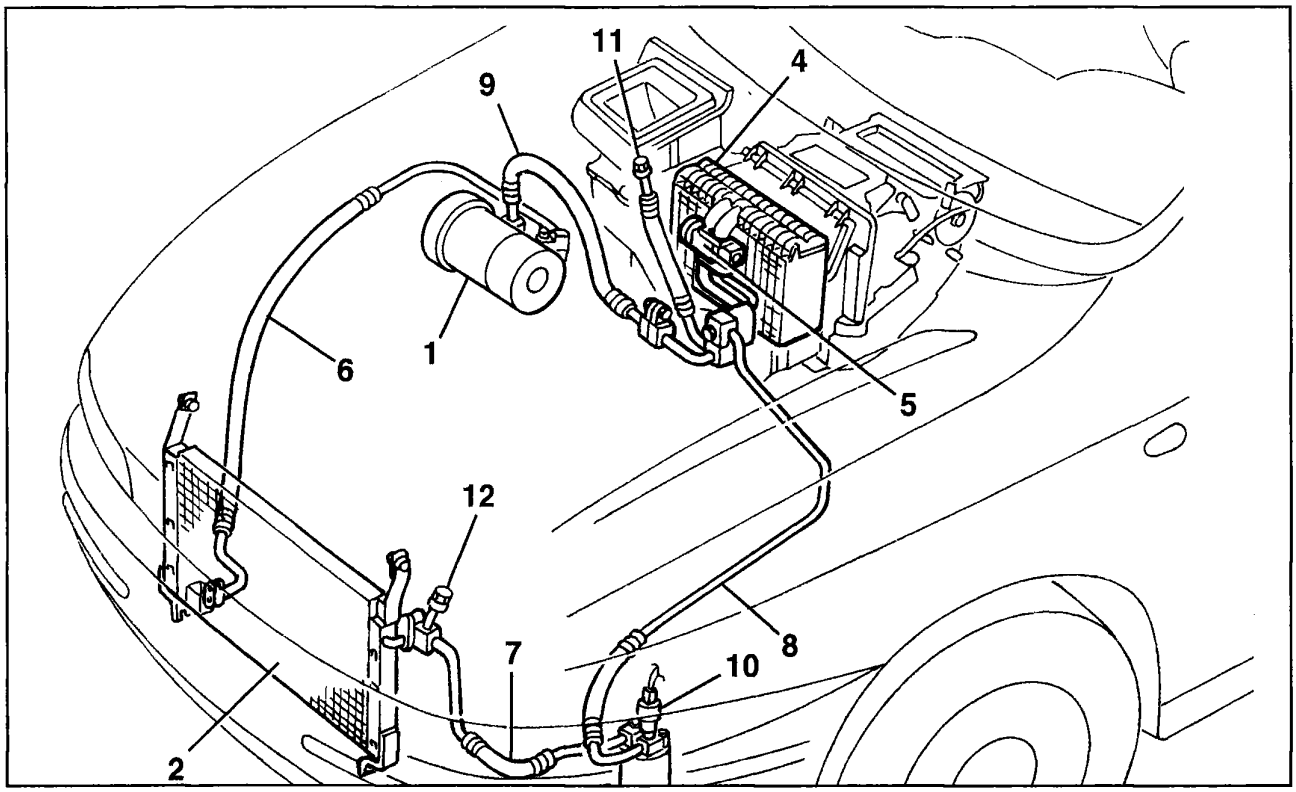
1. Compressor
2. Condenser
3. Drier filter
4. Evaporator
5. Expansion valve
6. Pipe between compressor and condenser
7. Pipe between condenser and drier filter
8. Pipe between filter and evaporator
9. Pipe between evaporator and compressor
10. Four stage pressure switch
11. Needle valve for draining system (low pressure side)
12. Needle valve for draining and re-pressurizing system (high pressure side)



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# 50.

## 1242 16v ENGINE TYPE




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1. Compressor
2. Condenser
3. Drier filter
4. Evaporator
5. Expansion valve
6. Pipe between compressor and condenser
7. Pipe between condenser and drier filter
8. Pipe between filter and evaporator
9. Pipe between evaporator and compressor
10. Four stage pressure switch
11. Needle valve for draining system (low pressure side)
12. Needle valve for draining and re-pressurizing system (high pressure side)



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## COMPRESSOR

All the compressors adopted are the variable capacity type, but they differ according to the engine type, as illustrated in the table below

| ENGINE TYPE | COMPRESSOR |
|---|---|
| 1242 16v | SCROLL SCS08 |
| 1581 16v | NIPPODENSO TV12 SC (•) |
| 1747 16v | NIPPODENSO TV12 SC (•) |
| 1998 20v | NIPPODENSO TV12 SC (•) |
| 1910 75cv | NIPPODENSO TV12 SC (•) |
| 1910 JTD | SANDEN SD 7V16 |
| 2387 JTD | DENSO 7SB16 |

(•) this is the same compressor used on the previous version: see the description in the Marea-Marea Weekend Service Manual.



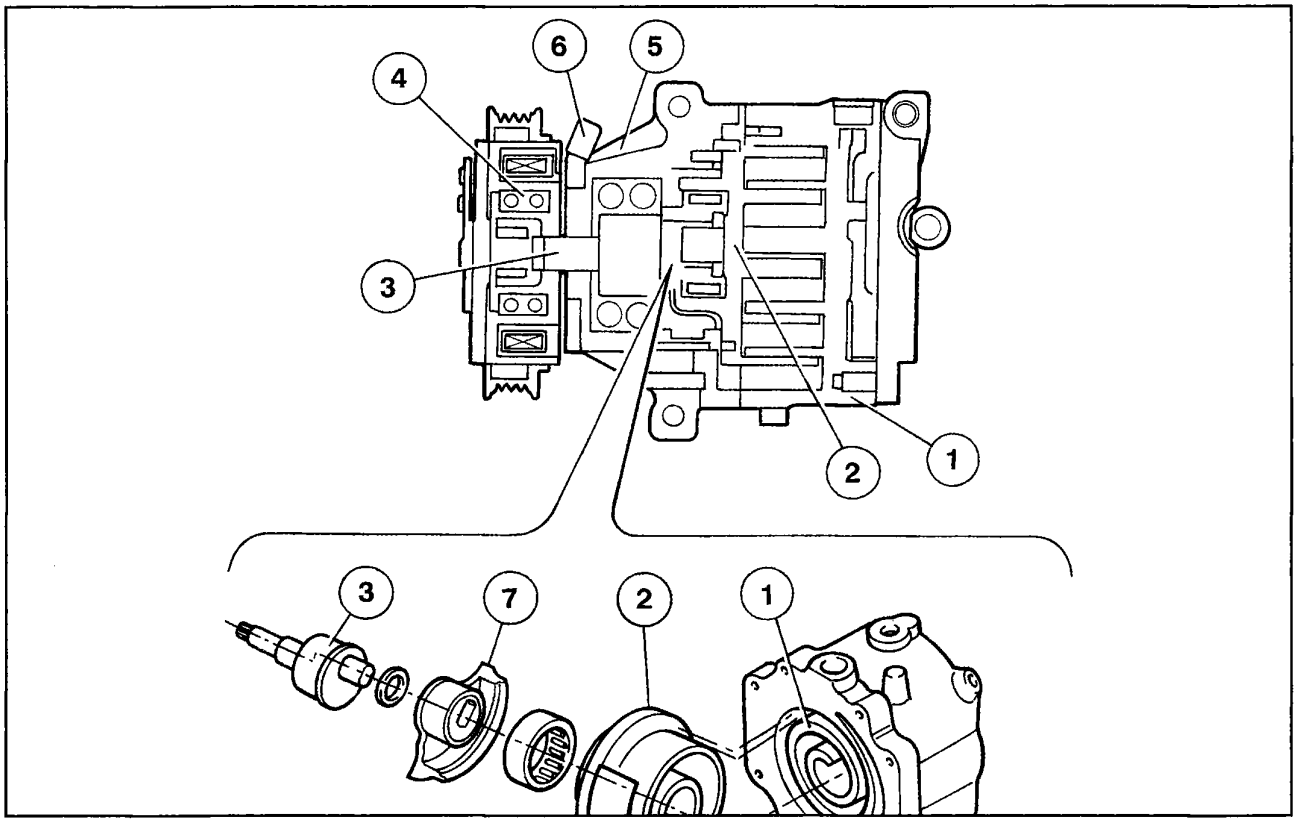
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# 50.

## SCROLL COMPRESSOR (engine 1242)

The compressor fitted on this version is the scroll type and has a system which deactivates it when the temperature of the evaporator reaches levels where freezing might take place.
The compressor consists of a fixed casing (1) and an orbital casing (2); the movement of these two casings, achieved via the eccentric camshaft (3), connected to the pulley, creates a chamber whose volume decreases during the rotation allowing compression.

The adoption of this compressor, consisting of two moving parts only, has led to the following advantages:
- no gaskets are required;
- there are no leaks, either radial or axial;
- low wear losses due to the absence of internal pipes and valves;
- the wear of the spirals improves the seal at the sides of the actual coils;
- the absence of valves, knocking and impulses reduces noise levels.




4A17CH01

1. Fixed casing
2. Orbital casing
3. Eccentric camshaft
4. Eccentric camshaft seal
5. Shield
6. Compressor supply electrical connection
7. Balancing mass

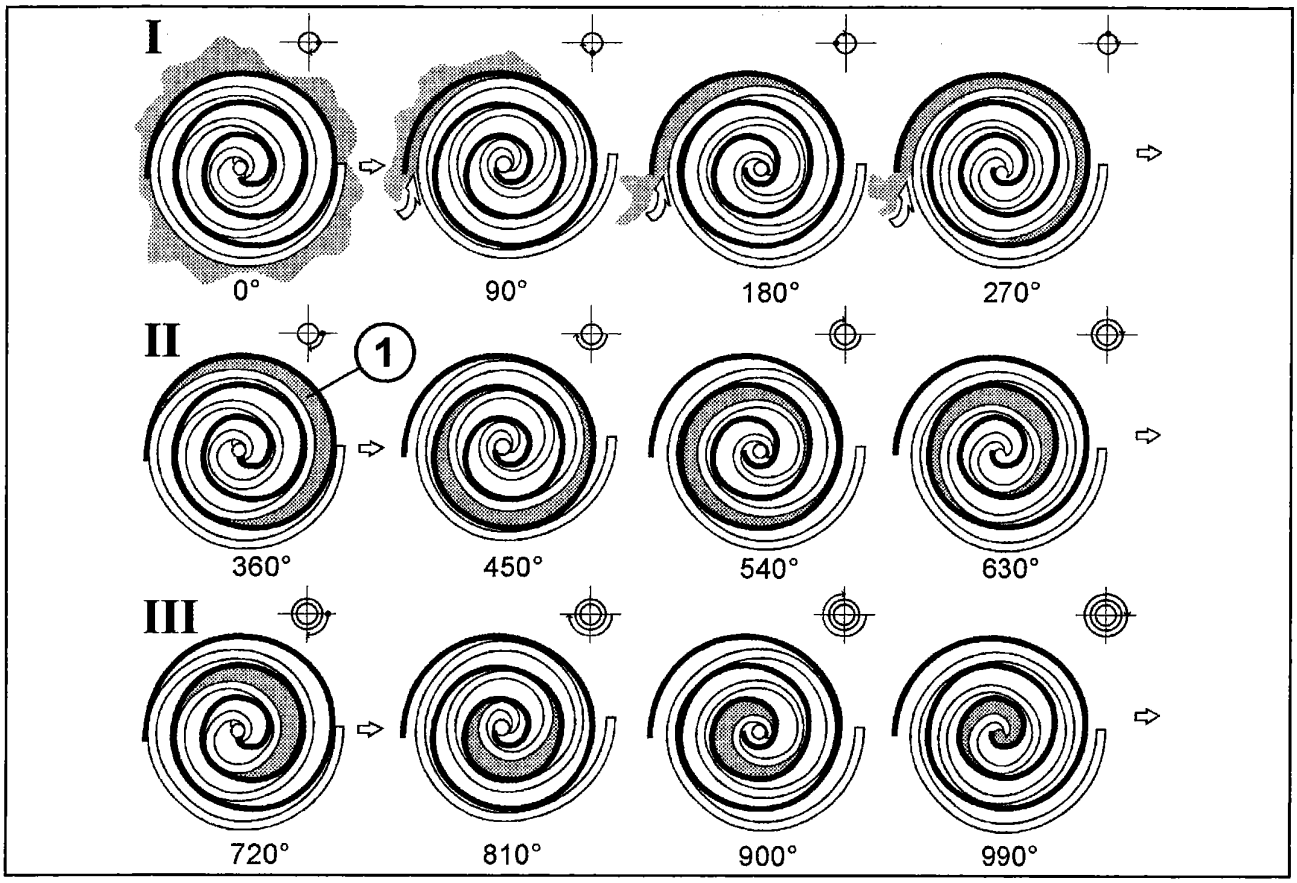


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Compression mechanism

The contact between the fixed casing and the compressor casing produces a chamber (1) in which the gas remains imprisoned with the volume tending to gradually decrease as the orbital casing completes its rotation. As illustrated, the compression chamber is alternately open to supply the gas, closed for transporting it and then again open (at the outlet connector) for the escape of the pressurized gas.

The volume defined by the two scrolls, decreases determining the compression mechanism for the gas stored. The pressure gradually increases until the gas reaches the centre area where operating pressure is reached; at this point the gas is released via the outlet connector to the condenser.




4A18CH01

The sequence illustrates the different gas compression stages; compression takes place after three complete revolutions of the orbital casing. Naturally, the cycle is continuous, therefore the moment a compression phase occurs, a gas intake phase is starting as the same time and the previous stage ends with the release of pressurized gas.

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## SANDEN SD7V16 COMPRESSOR (engine 1910 JTD)

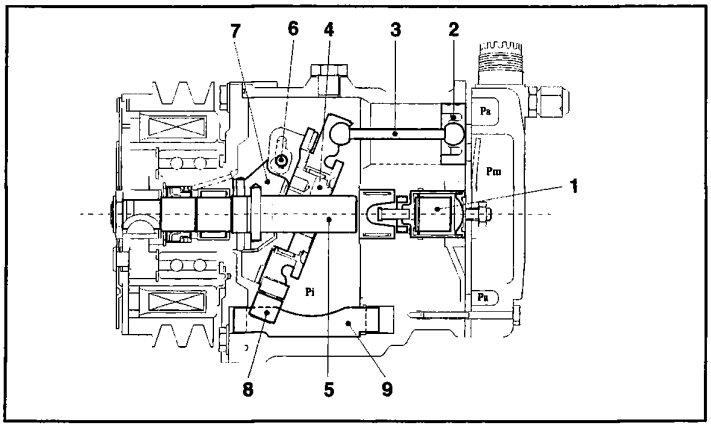
The compressor fitted on this version is the SANDEN SD7V16 variable capacity type.
The capacity of the compressor varies starting from the maximum value (161.3 $cm^3$/rev) and is gradually reduced (up to 10.4 $cm^3$/rev) according to the system load variations. - changed outside temperature and/or humidity conditions or sharp variations in the engine load.
This solution is defined as "unlimited variable capacity".
The compressor is the alternating piston type: the variation in capacity is achieved by tilting the connecting rod holder plate with a consequent variation of the piston stroke: the movement of the plate is activated by an internal regulation valve according to the balance of pressure upstream and downstream of the compressor. In particular, a low intake pressure involves the shuttering of the compressor (reduced capacity), whilst a high pressure involves operation at maximum power (maximum capacity).

### Operation

The SD7V16 compressor is illustrated in the diagram below: it consists of seven pistons (2) and connecting rods (3) secured to a connecting rod holder plate (4). The rotary motion of the plate (4), on the shaft (5) produces the alternating movement of the pistons.
Chaning the inclination of the plate alters the capacity: the maximum angle (as illustrated) produces the maximum capacity; virtually zero inclination (vertical position) for the minimum capacity, almost zero.
The plate (4) rotates around the pin (6) hinged on the shaft (5) arm (7).
The movement of the plate (4) in relation to the shaft (5) takes place by means of splining made from a low resistance material.
The plate (4) slides below along a guide (9) via a runner (8) made from a low friction material.
The diaphragm valve (1) controls the flow rate adjustment according to the difference between Pa (intake pressure) and Pi (pressure inside the compressor).
N.B. the solution adopted for this compressor is designed to keep the internal pressure Pi constant, with advantages in terms of ease of adjustment and quiet, smooth operation.

1. Diaphgram valve
2. Pistons
3. Connecting rods
4. Connecting rod plate
5. Shaft
6. Pin
7. Arm
8. Slide
9. Guide

Pa inlet pressure
Pi pressure inside the compressor
Pm supply pressure




4F010DH01



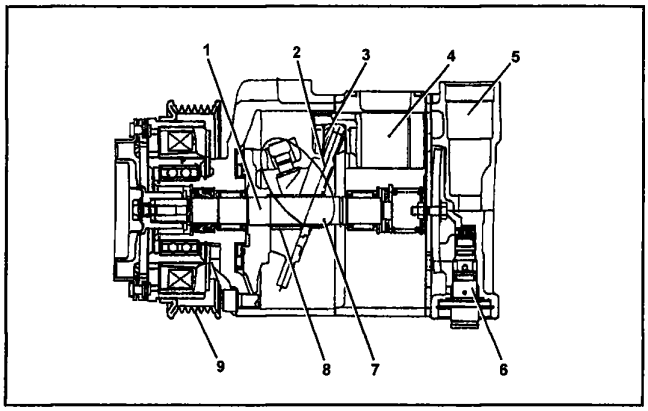
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## DENSO 7SB16 COMPRESSOR (engine 2387 JTD)

The compressor fitted on this version is the DENSO **7SB**16 variable capacity swash plate type.
The capacity of the compressor varies between a maximum value (161.55 cc/rev) and a minimum value (~8cc/rev) according to the thermal load in the climate control system: this feature makes it possible to reduce the capacity (and consequently the power of the compressor) according to the refrigerant power needed.
The alternating piston type compressor varies the capacity through the inclination of the rotary plate (swash plate) which defines the piston stroke. The way the pistons are connected to the plate, which identifies the technology, makes it possible to have a single plate which turns and guides the pistons with the advantage of reducing vibrations, noise and torque fluctuations.
The variation of the capacity is achieved via an adjustment valve which balances the pressure inside the compressor casing according to the compressor inlet and outlet pressure. The balancnig of the forces due to the pressure makes it possible to adjust the angle of the plate and, consequently, the capacity. The maximum capacity is obtained with the plate in the maximum inclination position whilst when the plate is virtually vertical the capacity is minimal. The compressor is started up at minimum capacity thanks to a special spring.

### Operation

The motion is transmitted by the auxiliary shaft belt to the pulley (9) and, consequently, when the electro-clutch is activated, to the shaft (1). The rotary motion is transformed into a rectilinear motion of the pistons (4), via the plate (2) which is in one piece with the shaft and slides on the piston runners (3). The adjustment valve (6) controls the capacity so that the intake pressure is as desired. The spring (8) returns the plate to the minimum capacity position when the compressor is deactivated. The muffler (5) reduces the intake gas impulses and consequently the noise and vibrations.



4F011DH01

1. Shaft
2. Plate
3. Pad
4. Piston
5. Intake muffler
6. Valve
7. Swash plate mechanism
8. Minimum capacity spring
9. Pulley



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# 50.

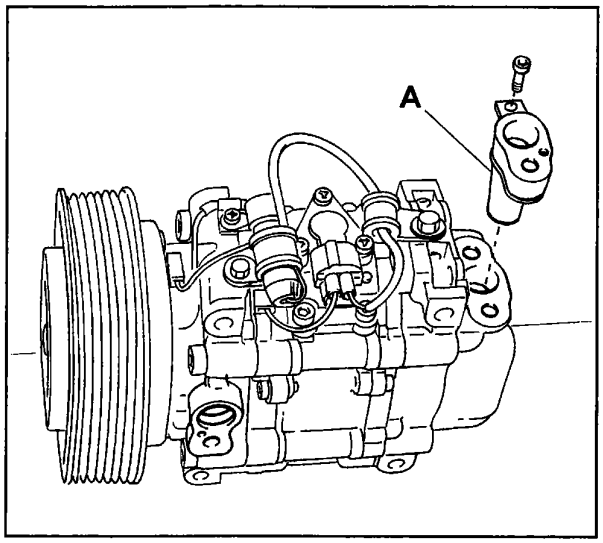
## TOPPING UP OIL LEVEL

### Replacing compressor

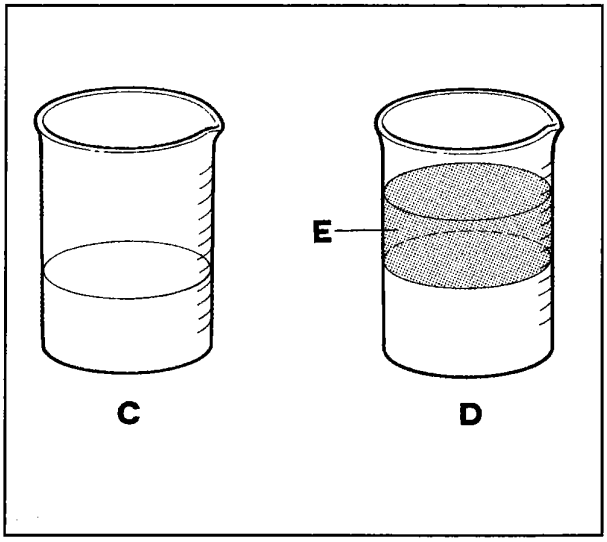
*The compressor is avaiable as spares pressurized with nitrogen to prevent the intake of dampness and impurities; therefore, when fitting, the plugs for the inlet and outlet connectors must be removed slowly with the compressor positioned exactly as illustrated in the diagram below (with the cover facing upwards).*

**Only for NIPPONDENSO RV12SC compressor**
- Remove the oil separator (A) fixed near the outlet connector for the compressor which should be replaced.

**Other compressors**
- Remove the oil drain plug on the compressor which should be replaced.
- Introduce the amount of oil in the compressor into a graduated test tube (C) taking care to let it drain well.
- Remove the oil separator (A) from the new compressor and pour the amount of oil contained into a graduated test tube (D) taking care to let it drain well.
- Remove the excess oil (E) corresponding to the difference between the quantity of oil contained in test tube (C) and test tube (D) (E = D-C).



4F20AH01



4F20AH02

*The oil is extremely hygroscopic: avoid leaving the containers open.*
*Avoid leaving the compressor or any other component disconnect from the system for any longer than is strictly necessary.*
*Do not tilt the compressor or turn it upside down.*

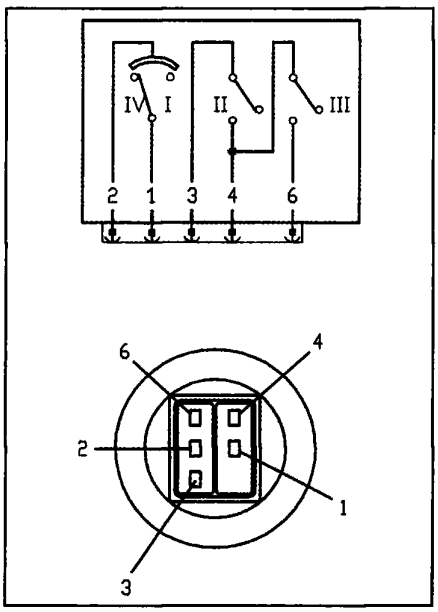
### QUANTITY AND TYPE OF OIL CONTAINED IN THE COMPRESSOR

| COMPRESSOR | TYPE | QUANTITY |
|---|---|---|
| SCROLL SCS08 | ND8 | 80 ± 20 $cm^3$ |
| NIPPODENSO TV12SC | ND9 | 150 ± 20 $cm^3$ |
| SANDEN SD7V16 | SP20 | 135 $cm^3$ |
| DENSO 7SB16 | ND8 | 120 ± 15 $cm^3$ |



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**FOUR STAGE PRESSURE SWITCH**The four stage pressure switch has the task of activating the engine coolant radiator and condenser cooling fan when the vehicle is stationary or driving in traffic and the flow of air produced by the vehicle moving forward is insufficient and the condensation of the **R134a** fluid must be activated through ventilation: contact (II) closes at around 15 bar (engagement of first speed), whilst contact (III) closes at around 20 bar (engagement of second speed). In addition, the three stage pressure switch is designed to de-energize the compressor pulley electro-magnet coupling when, in spite of the action of the fan or as a result of its failure to operate, the pressure of the refrigerant fluid (high pressure side) reaches dangerous levels (contact IV - beyond about 25 bar) or when, as a result of a possible leak or because the outside temperature is below 10 degrees **C** (and the thermal load conditions are not sufficient to evaporate the **R134a** fluid) the pressure of the fluid reaches a value below around 2.5 bar (contact I).

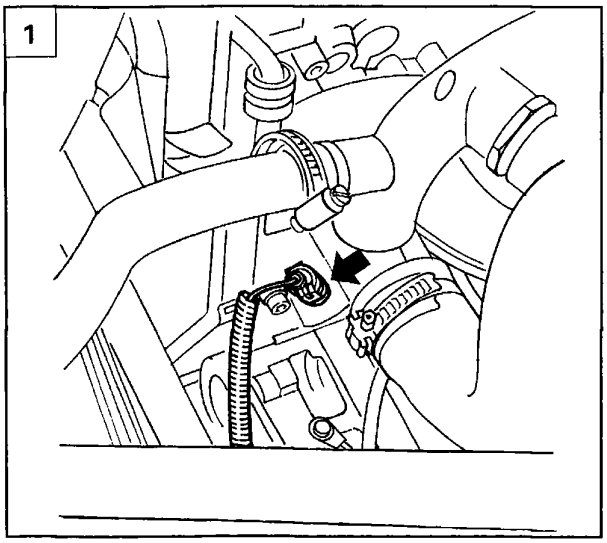


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# 50.




4A25CH01

## COMPRESSOR

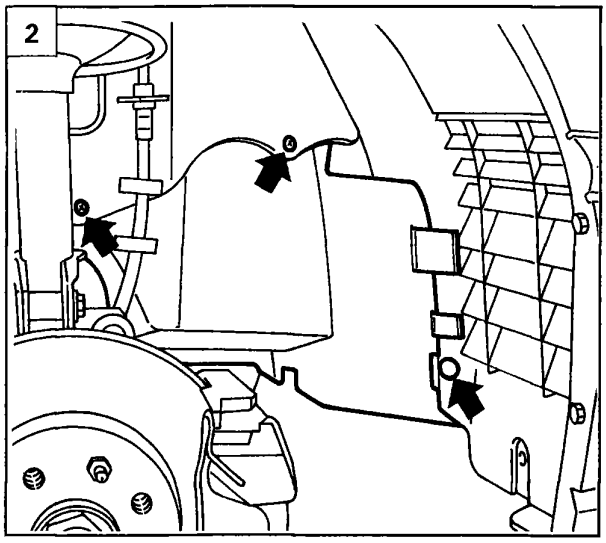
### Removing

1. Position the vehicle on *a* lift, disconnect the negative battery lead and drain the climate control system, then carry out the following operations in the order given:

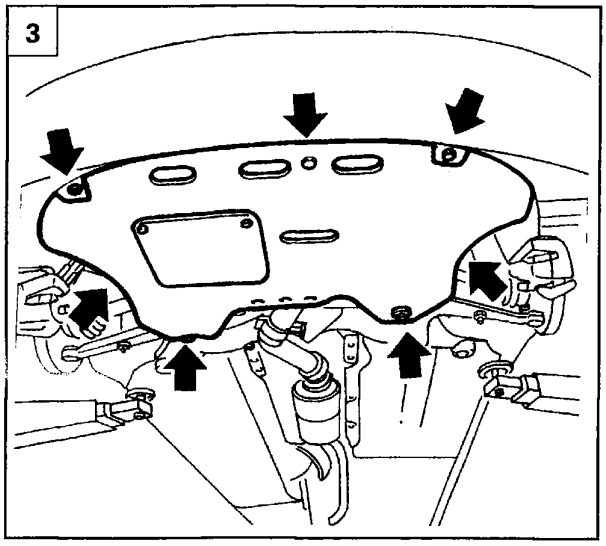
- disconnect the connector and release it from the retaining band;

2. raise the vehicle and remove the right front wheel, remove the clip and undo the bolts shown in the diagram fixing the wheel arch liner to the bodyshell.
3. Undo the bolts shown in the diagram and remove the lower shield from the engine compartment.
4. Acting on the belt tensioner, loosen the tension for the single components drive belt; release the belt from the pullies and remove it.

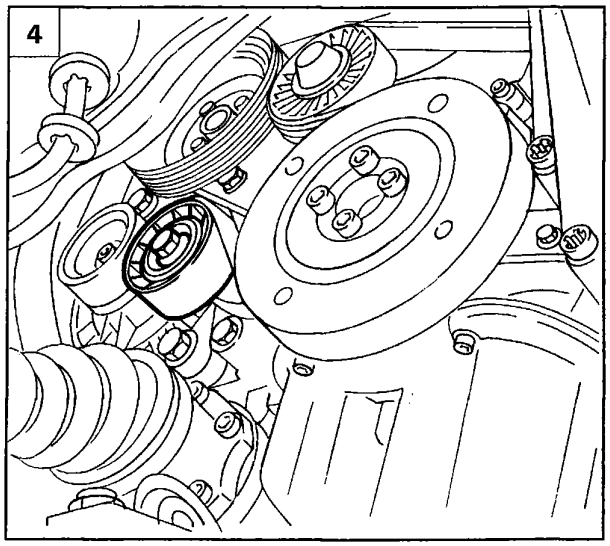
**NOTE** *Avoid the belt coming into contact with oil or solvents which could adversely affect the elasticity of the rubber and reduce the adhesion properties. Also check that there are no cracks or cuts in the belt or else it must be replaced.*




4A25CH02



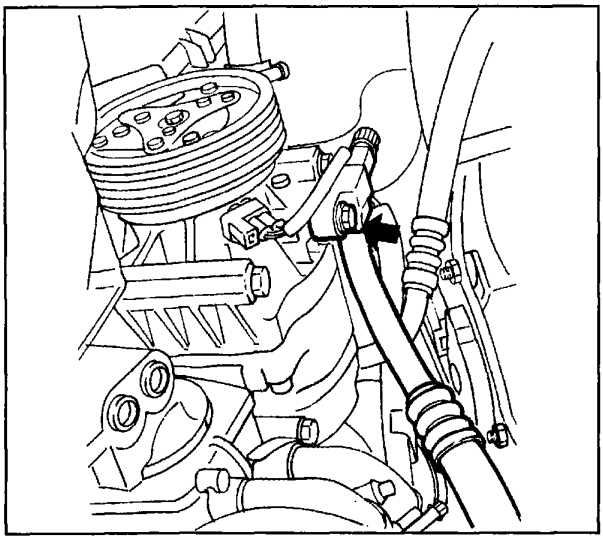

4A25CH03




4A25CH04

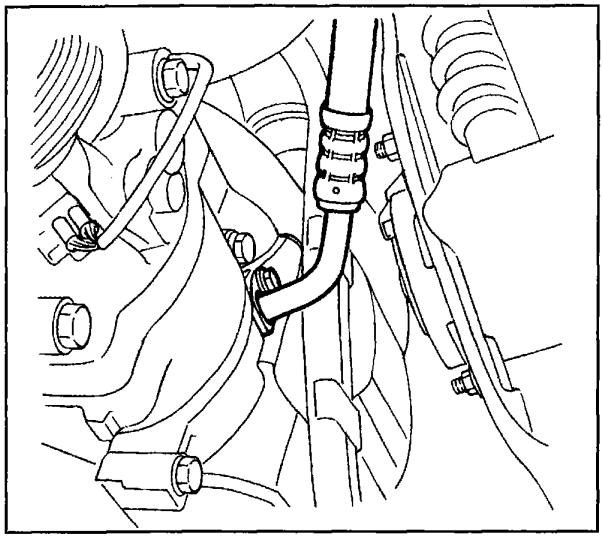


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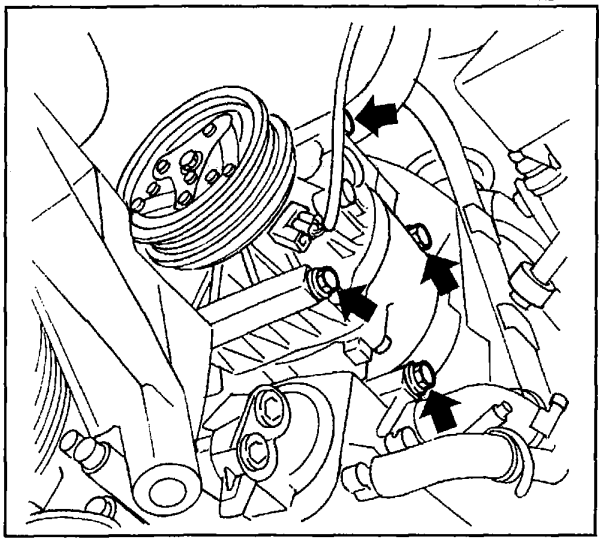
4A26CH01

- Undo the bolt shown in the diagram and release the pipe from the compressor inlet duct;
- seal both the end of the pipe and the compressor duct using suitable plugs;



4A26CH02

- Undo the bolt shown and release the pipe from the compressor inlet duct;
- seal both the ends of the pipe and the compressor duct using suitable plugs;



4A26CH03

- Undo the bolts shown in the diagram and remove the compressor;

### Refitting

To refit, suitably reverse the order of the operations carried out for the removal.



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# Electrical equipment

## Contents

## 55.

page

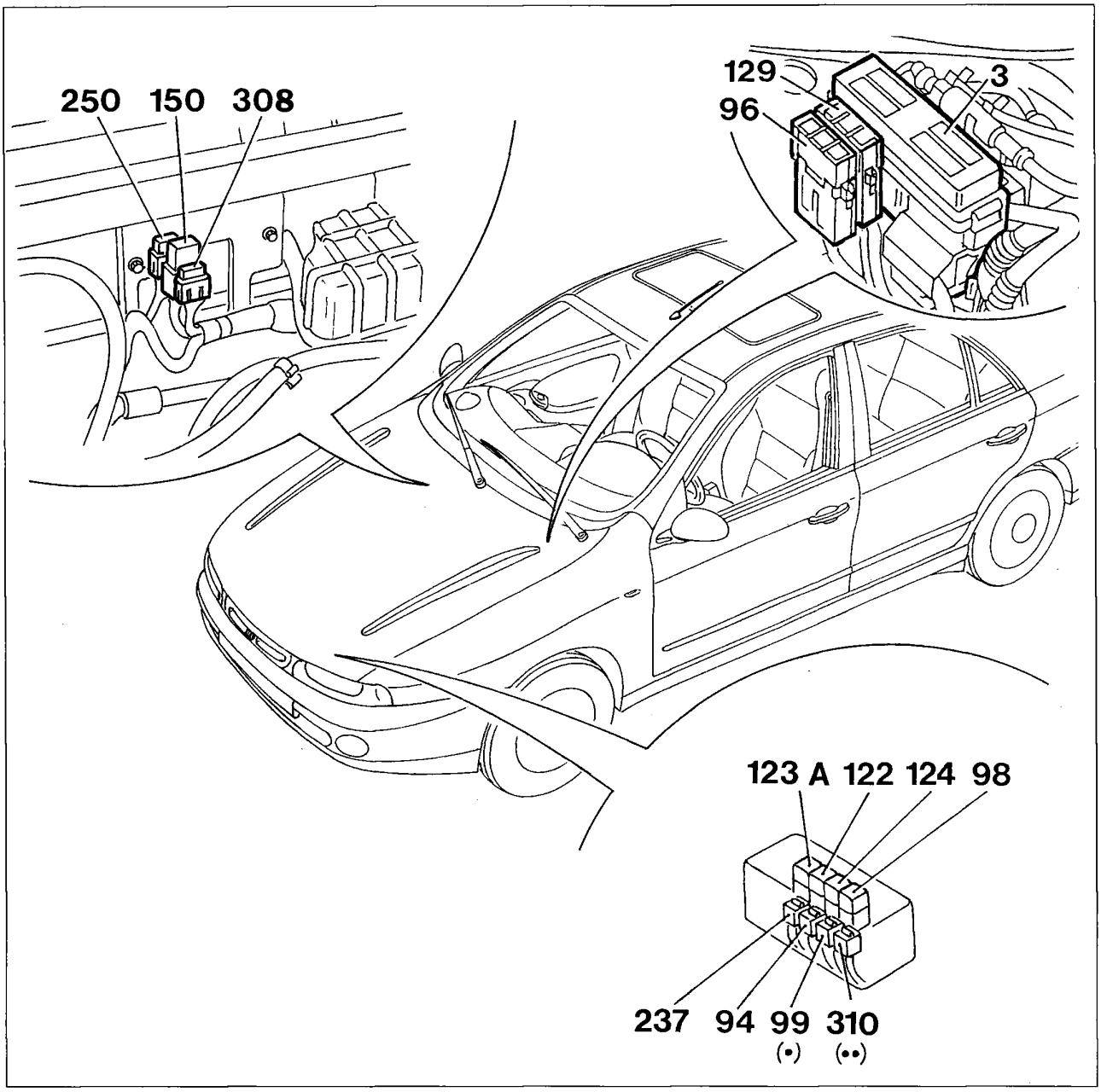
### LOCATION OF COMPONENTS ON VEHICLE

– Location of relays and fuses on vehicle 1
– Location of control units and tester sockets 2

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## LOCATION OF RELAYS AND FUSES ON VEHICLE




P4F003L02

3. Power fuse box
94. ABS fuse
96. ABS system power fuse
98. Headlamp washer intermittent function
90. Headlamp wiper fuse
122. Engine cooling fan low speed relay
123A. Engine cooling fan high speed relay
124. Air conditioner compressor control relay
129. Engine cooling fan power fuse
150. Injection system control relay
237. FIAT CODE fuse
250. Fuel pump fuse
308. Injection system and Fiat CODE fuse
310. Headlamp washer and air conditioner fuse
(●●) Versions with air conditioner
(●) Versions without air conditioner

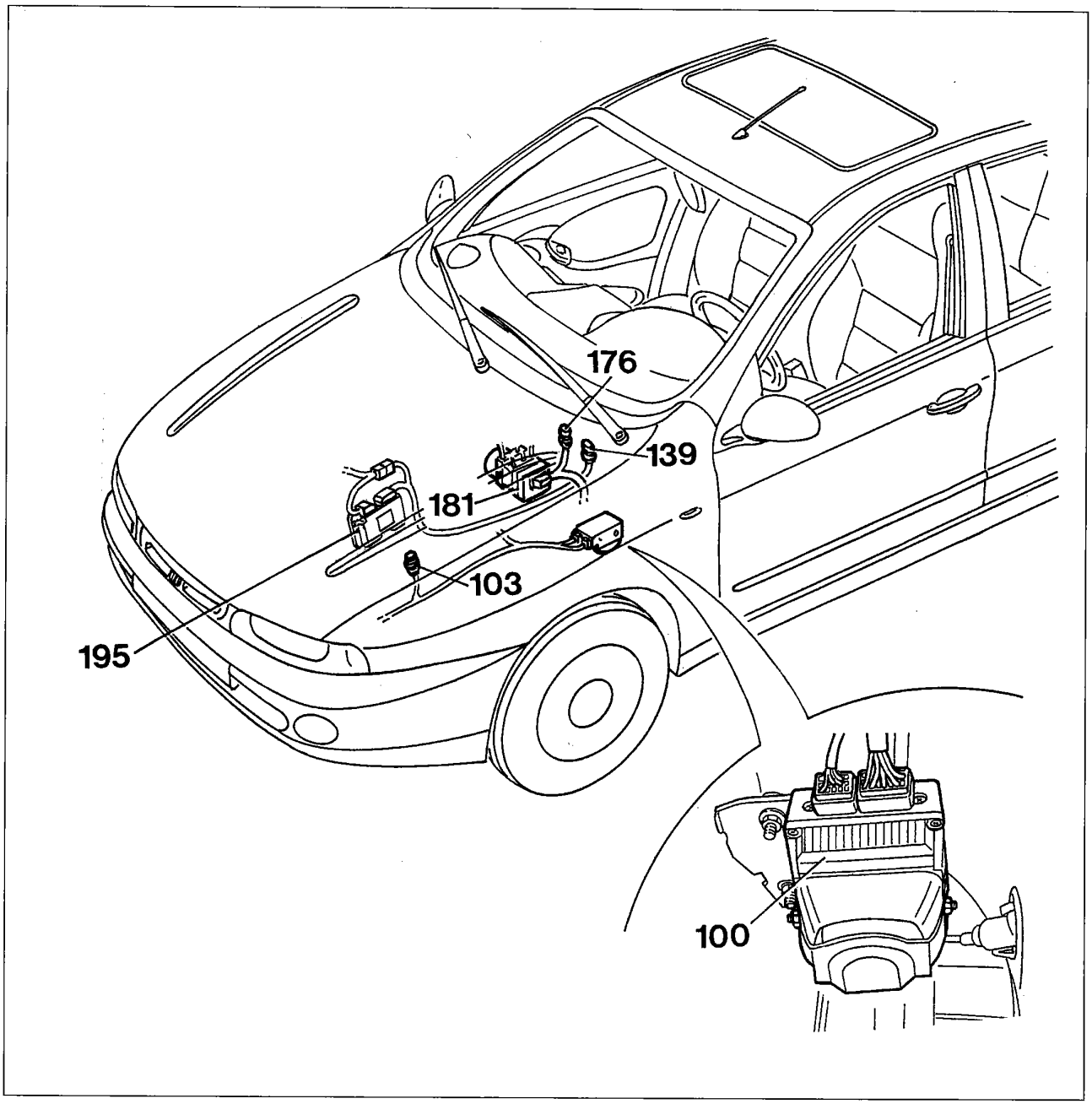
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# 55.

## LOCATION OF CONTROL UNITS AND TESTER SOCKETS (ENGINE BAY)




P4F005L02

100. Alarm electronic control unit
103. Tester connection for alarm
139. Tester connection for injection system
176. Tester connection for ABS device (A.B.S.)
181. Hydraulic control unit for anti-lock brakes (A.B.S.)
195. Ignition/injection electronic control unit



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page

– **WIRING DIAGRAMS** 1
– **Connector blocks** 15

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| NAME | Marea - Marea Weekend |
|---|---|
| Fuel level gauge and reserve warning light - Handbrake on and low brake fluid warning light - Speedometer - Total mileage counter/trip recorder and reset button - Coolant temperature gauge - Low engine oil pressure warning light - Front brake pad wear warning light - Seat belt warning light | 1 |
| Fiat CODE system and warning light | 3 |
| Thermostatically-adjusted heater/air conditioner | 5 |
| Versions with air conditioner<br>Engine cooling system - Coolant temperature gauge | 7 |
| Versions without air conditioner<br>Engine cooling system - Coolant temperature gauge - Manual heater: car interior ventilation | 9 |
| Starter - Electronic ignition and fuel injection - Recharging and warning light - Low engine oil pressure warning light - Fuel injection fault warning light - Rev counter | 11 |
| Anti-lock braking system (A.B.S.) and fault warning light (*) | 13 |

*(*) All engines*

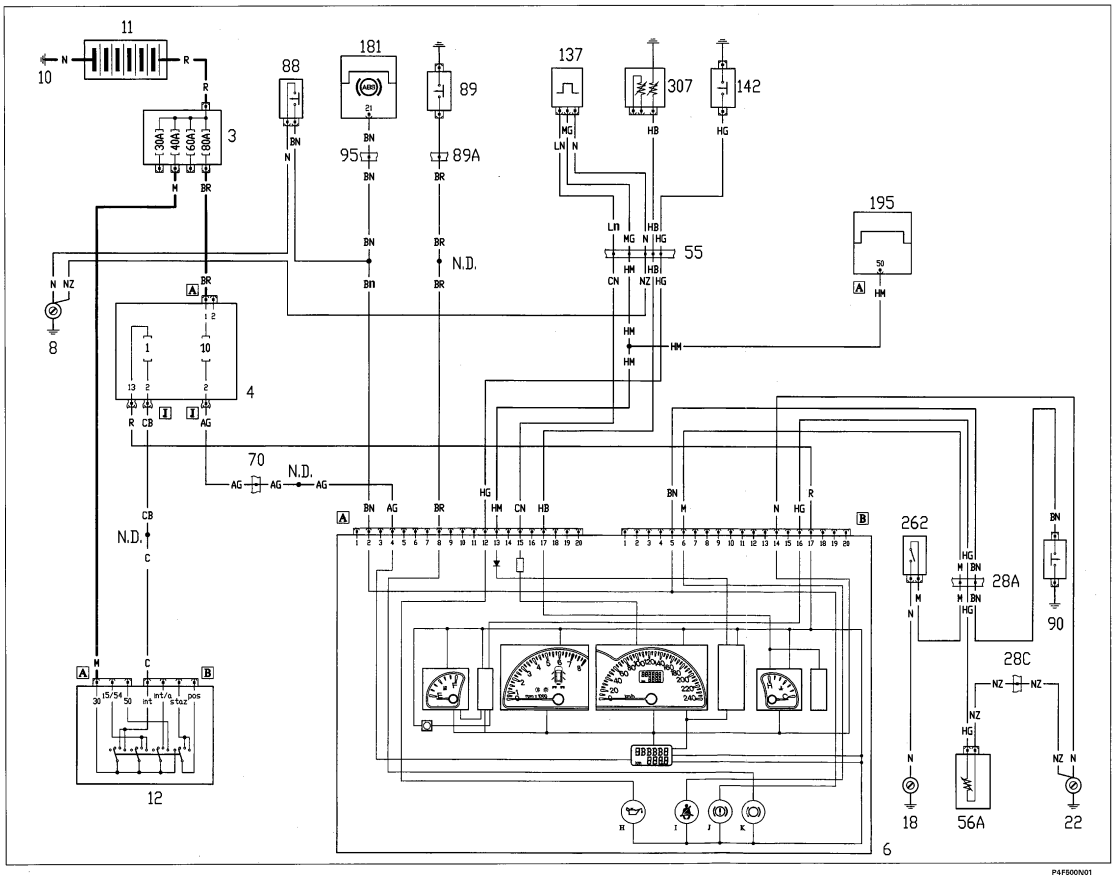


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# 55.

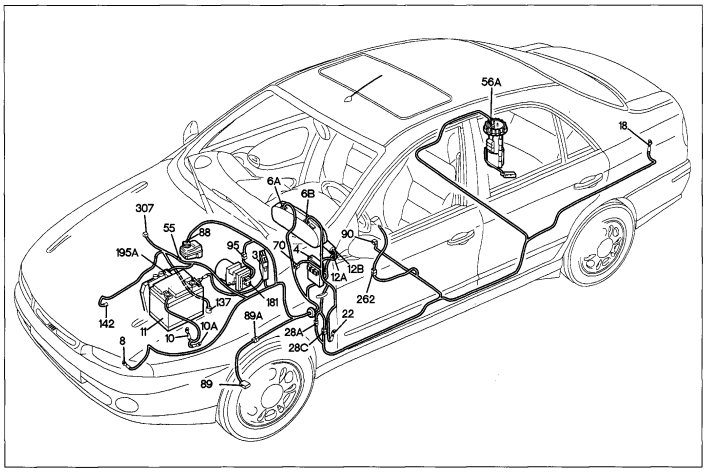
**Fuel level gauge and reserve warning light - Handbrake on and low brake fluid warning light - Speedometer - Total mileage counter/trip recorder and reset button - Engine coolant temperature gauge - Low engine oil pressure warning light - Front brake pad wear warning light - Seat belt warning light**




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P4F501N01

**Fuel level gauge and reserve warning light - Handbrake on and low brake fluid warning light - Speedometer - Total mileage counter/trip recorder and reset button - Engine coolant temperature gauge - Low engine oil pressure warning light - Front brake pad wear warning light - Seat belt warning light**

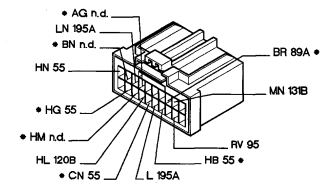
**Key to components**

3 Power fusebox
4 Fuse and relay unit
6 Instrument panel
8 Front left earth
10 Battery earth on engine
10A Battery earth on body shell
11 Battery
12 Ignition switch
18 Rear left earth
22 Left dashboard earth
28 Dashboard/rear cables connection
55 Front left/engine cables connection
56 Fuel gauge sender unit
70 Dashboard/front cables connection
88 Low brake fluid level sensor
89 Left brake pad wear sensor
89A Left brake pad wear sensor cables connection
90 Handbrake on warning light switch
95 Front cables/ABS cables connection
137 Car speed sensor
142 Low oil pressure warning light switch
181 ABS electrohydraulic control unit
195 Fuel injection/ignition electronic control unit
262 Seat belts warning light switch
307 Water temperature double sender unit

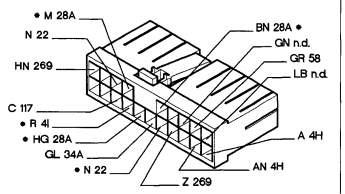
N.D. Ultrasound-soldered joint taped in wiring loom

4F02AN

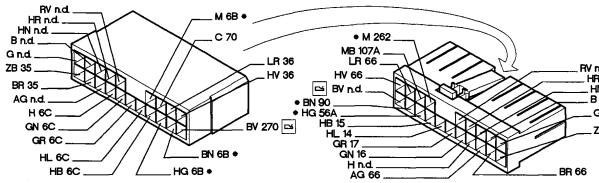
**6A** Instrument panel



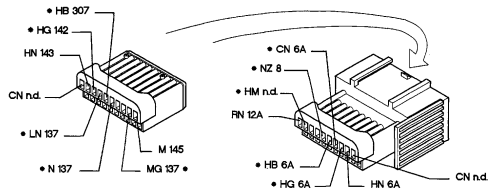

**6B** Instrument panel



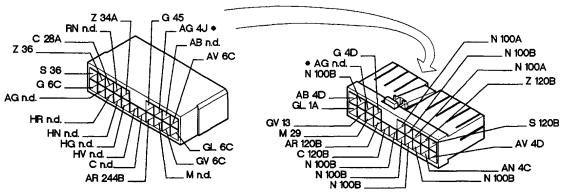

**28A** Dashboard/rear cables connection




**55** Front left/engine cables connection




**70** Dashboard/front cables connection




* The cables involved in the wiring diagram are marked with an asterisk.

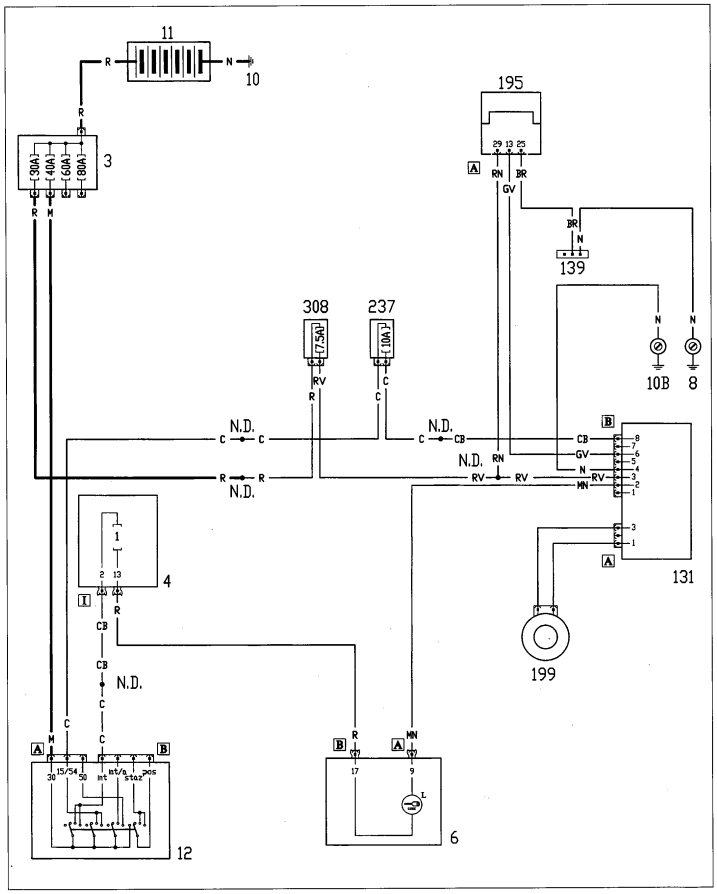
P4F501N02

4F03AN



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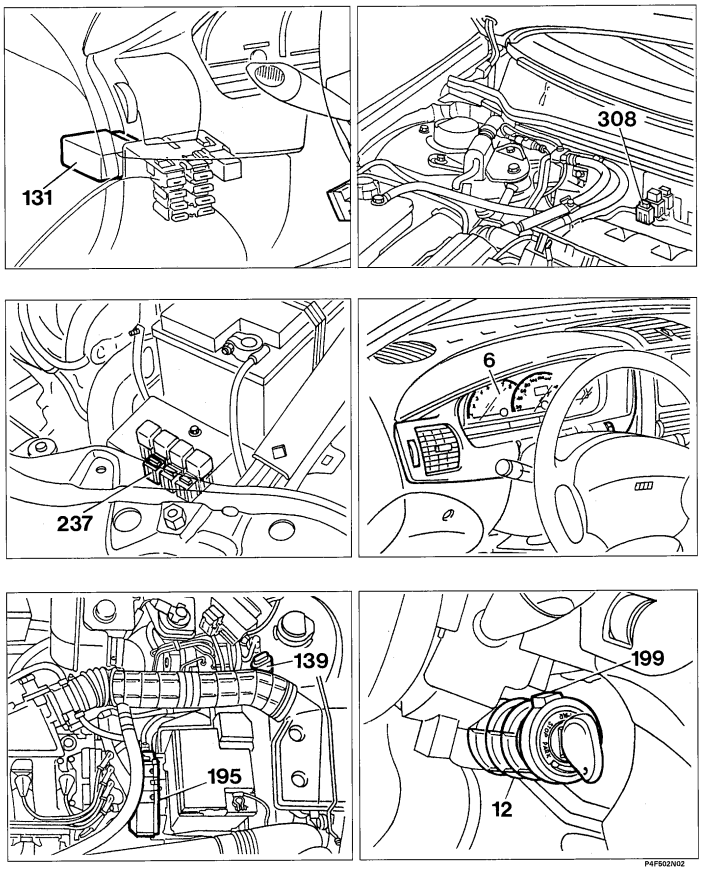
**Fiat CODE system and warning light**




P4F502N01

4F04AN

**Location of components**



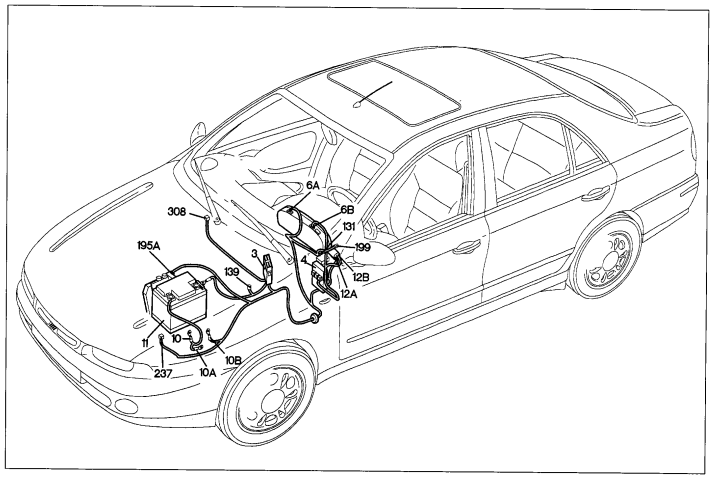

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Fiat **CODE system and warning light**

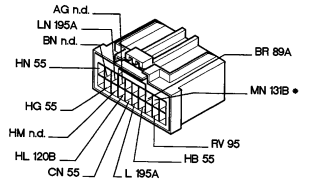
**Key to components**

3 Power fusebox
4 Fuse and relay unit
6 Instrument panel
10 Battery earth on engine
10A Battery earth on bodyshell
10B Battery earth for fuel injection
11 Battery
12 Ignition switch
131 Fiat CODE electronic control unit
139 Diagnostic socket for fuel injection
195 Fuel injection/ignition electronic control unit
199 Aerial for Fiat CODE system
237 Fuse protecting Fiat CODE
308 Fuse protecting fuel injection and CODE

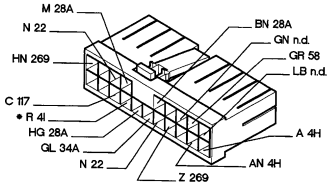
N.D. Ultrasound-soldered joint taped in wiring loom

4F06AN

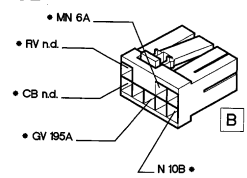
**6A** Instrument panel



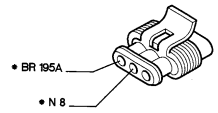

**6B** Instrument panel




**131B** Fiat Code electronic control unit

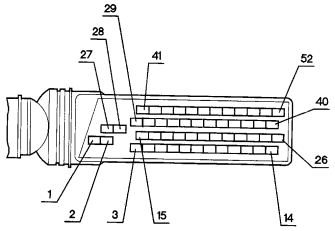



**139** Diagnostic socket for fuel injection




**195A** Fuel injection/ignition electronic control unit

| | | | |
|---|---|---|---|
| 4 | L 6A | 28 | N 10B |
| 9 | LN 141 | 29 | RN n.d. • |
| 13 | GV 131B • | 35 | A 309 |
| 14 | G 127 | 40 | CL 127 |
| 15 | SB 150 | 41 | RV 127 |
| 20 | L 141 | 47 | C n.d. |
| 21 | AR 309 | 48 | S 309 |
| 25 | BR 139 • | 50 | HM n.d. |
| 26 | LN 6A | 52 | RG 13 |
| 27 | N 10B | | |




* The cables involved in the wiring diagram are marked with an asterisk.

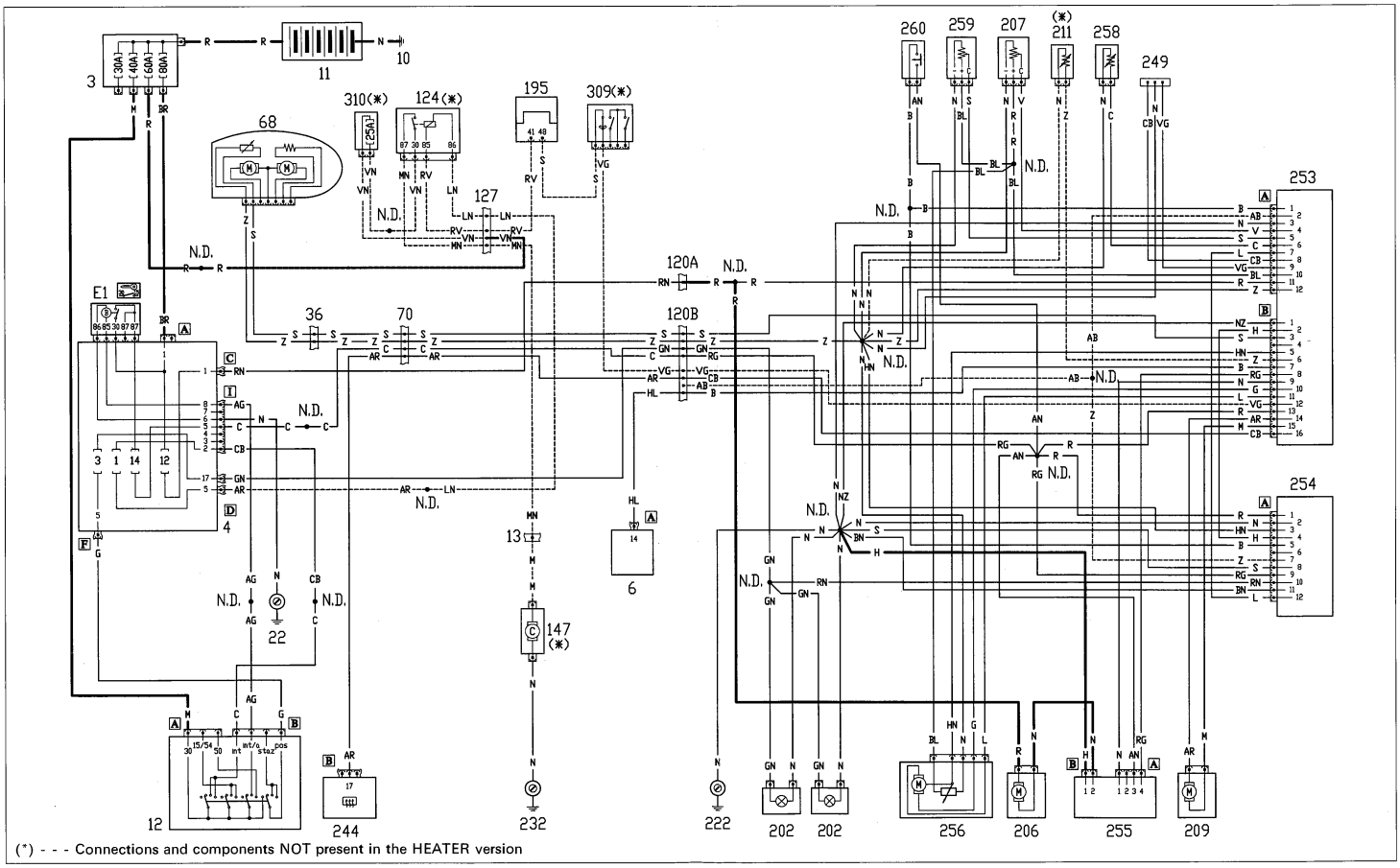
P4F503N02

4F07AN



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**Thermostaticaly-adjusted heater/air conditioner**

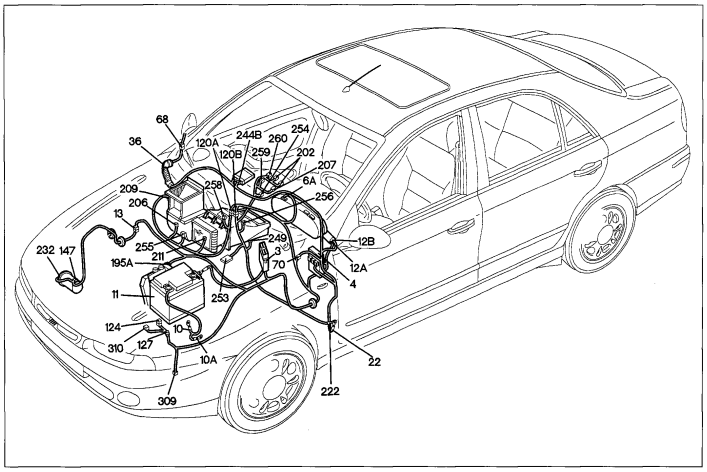



4F08AN

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P4F505N01

**Thermostatically-adjusted heater/air conditioner**

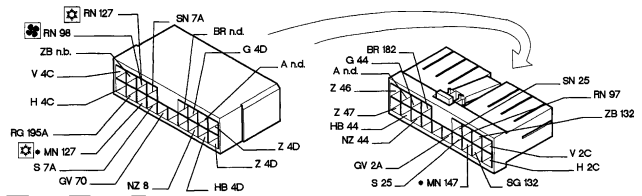
**Key to components**

3 Power fusebox
4 Fuse and relay unit
6 Instrument panel
10 Battery earth on engine
10A Battery earth on bodyshell
11 Battery
12 Ignition switch
13 Front right/left cables connection
22 Left dashboard earth
36 Dashboard/front right door cables connection
68 Right door mirror
70 Dashboard/front cables connection
120 Air conditioner cables connection
124 Air conditioner compressor relay
127 Connection between front left cable/relay bracket cable
147 Compressor for air conditioner
195 Fuel injection/ignition electronic control unit
202 Heater/air conditioner controls symbols light bulb
206 Car interior air climate control fan
207 Fan speed adjustment switch
209 Air intake flap control actuator
211 Anti-frost sensor
222 Earth for climate control system
232 Earth for compressor
244 Integrated services electronic control unit
249 Diagnostic socket for climate control system
253 Climate control system control unit
254 Climate control system controls with car interior temperature sensor
255 Electronic speed Variator for climate control fan
256 Air mixing control actuator
258 Treated air temperature sensor
259 Required temperature adjustment switch
260 "MAX-DEF" microswitch
309 4-stage pressure switch
310 Fuse for headlamp washer and air conditioner

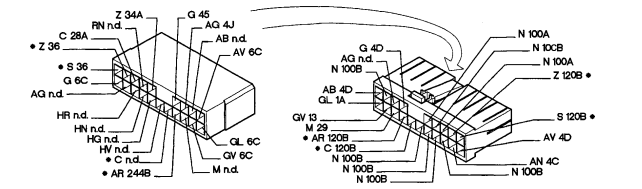
N.D. Ultrasound-soldered joint taped in wiring loom

4F10AN

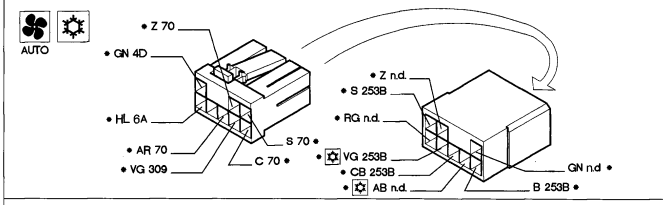
**13** Front right/left cables connection



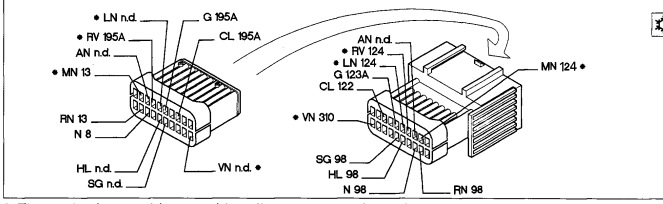

**55** Front left/engine cables connection




**120B** Air conditioner cables connection




**127** Connection between front left cable/cable on relay bracket




* The cables involved in the wiring diagram are marked with an asterisk.

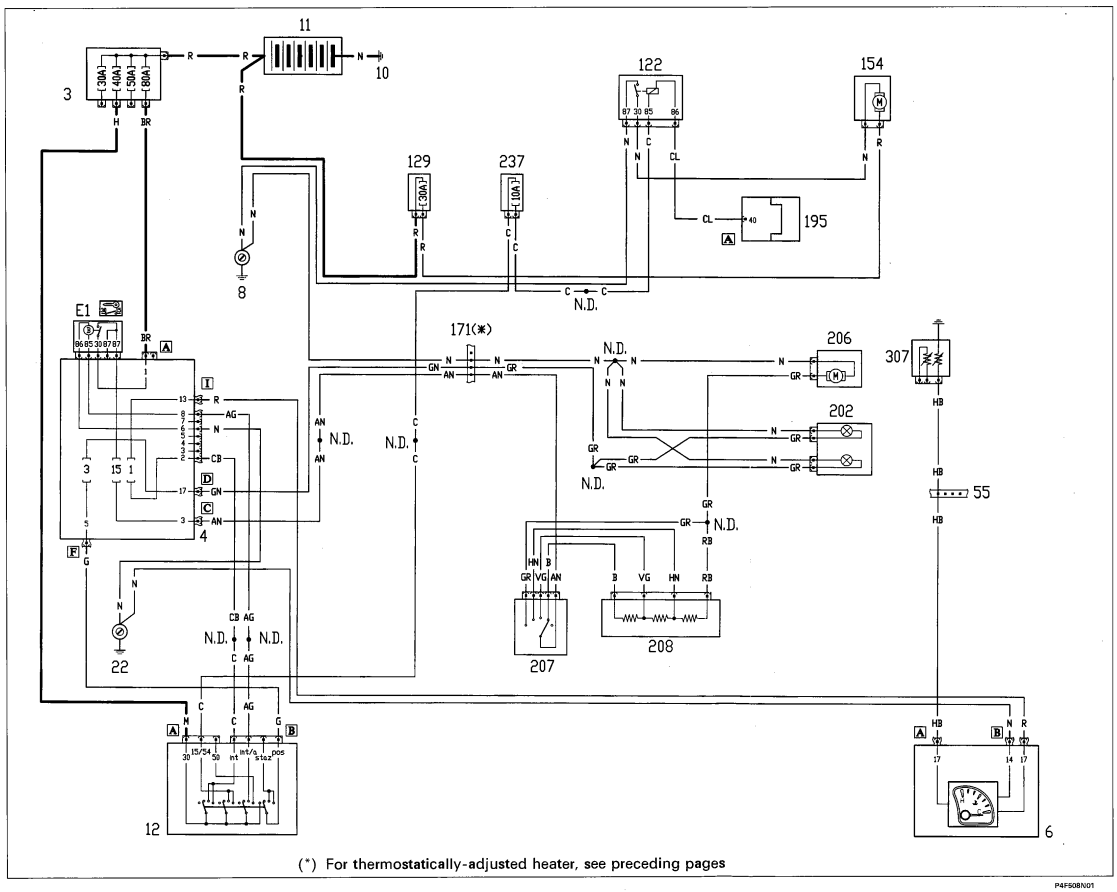
P4F506N02

4F11AN



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**Versions without air conditioner**
**Engine cooling system - Coolant temperature gauge - Manual heater: car interior ventilation**



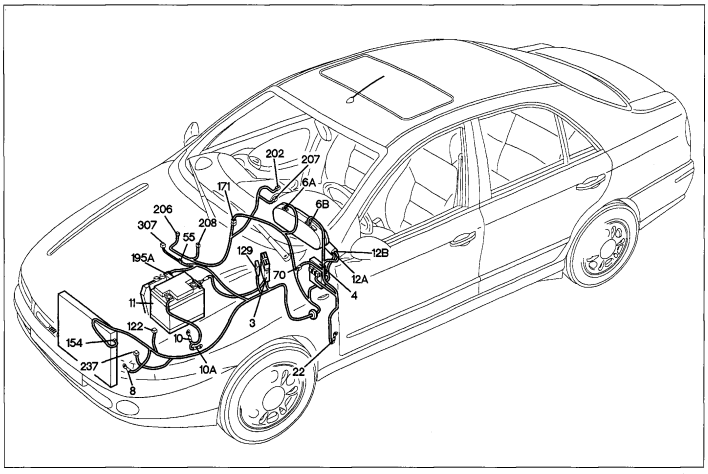

4F16AN

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# 55.




P4F509N01

**Versions without air conditioner**

**Engine cooling system - Coolant temperature gauge - Manual heater: car interior ventilation**

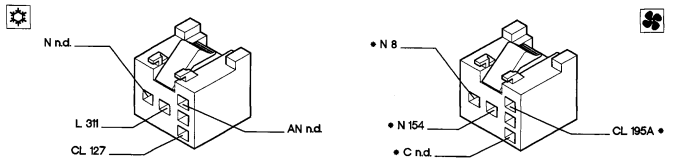
**Key to components**

3 Power fusebox
4 Fuse and relay unit
6 Instrument panel
8 Front left earth
10 Battery earth on engine
10A Battery earth on bodyshell
11 Battery
12 Ignition switch
22 Left dashboard earth
55 Front left/engine cables connection
70 Dashboard/front cables connection
122 Engine cooling fan low speed relay
129 Power fuse protecting engine cooling fan
154 Engine cooling fan
171 Heater unit cables connection
195 Fuel injection/ignition electronic control unit
202 Light bulb for heater/air conditioner controls symbols
206 Car interior climate control fan
207 Electric fan speed adjustment switch
208 Fan speed resistor
237 Fuse protecting Fiat CODE
307 Water temperature double sender unit

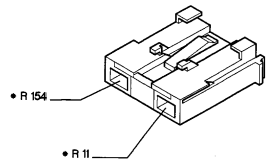
N.D. Ultrasound-soldered joint taped in wiring loom

4F17AN

**122** Engine cooling fan low speed relay

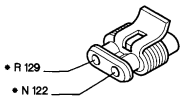



**129** Power fuse protecting engine cooling fan

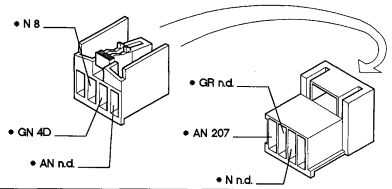



**154** Engine cooling fan

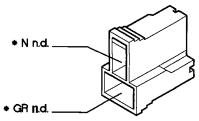
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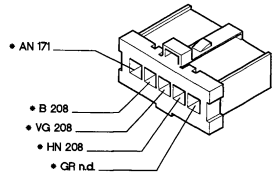

**171** Heater unit cables connection




**206** Car interior climate control fan




**207** Fan speed adjustmenet switch




P4F509N02

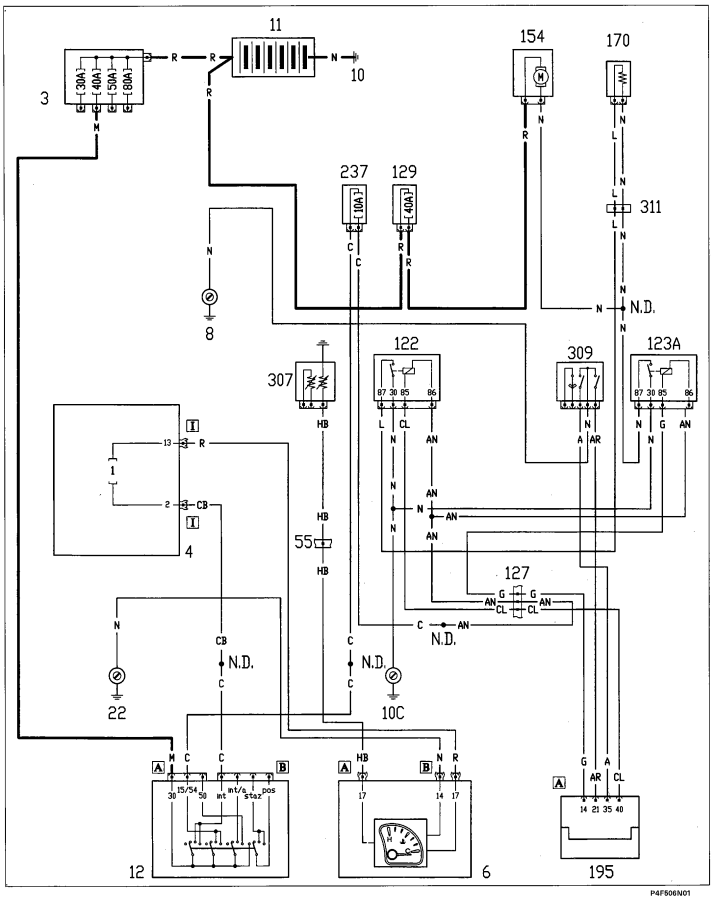
* The cables involved in the wiring diagram are marked with an asterisk.

4F18AN



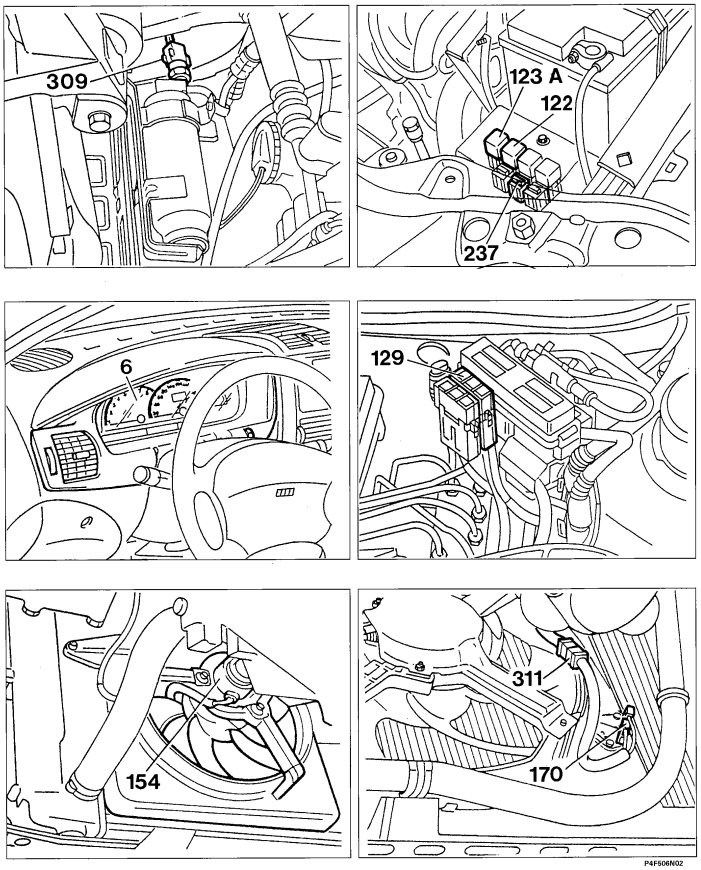
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**Versions with air conditioner**
**Engine cooling system - Coolant temperature gauge**




4F12AN

**Location of components**



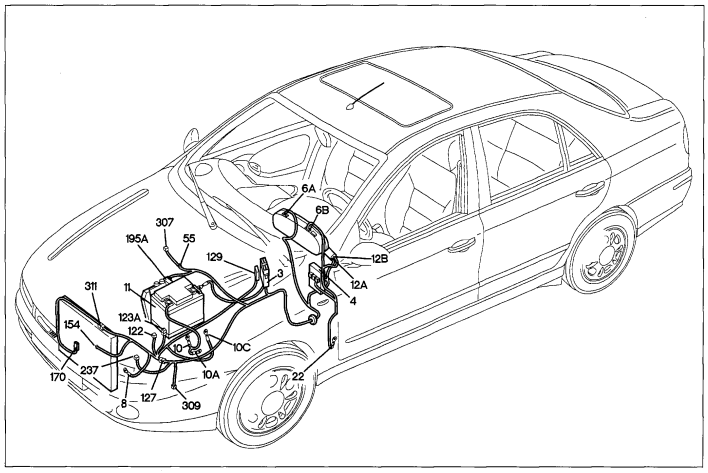

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# 55.




P4F507N01

**Versions with air conditioner**

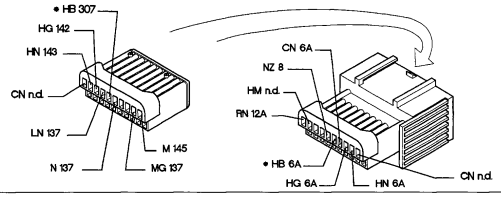
**Engine cooling system - Coolant temperature gauge**

**Key to components**

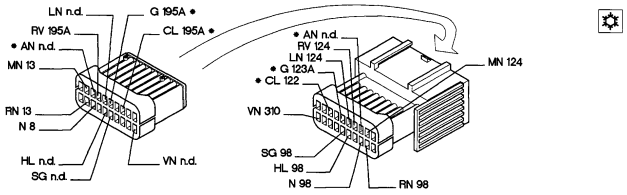
3 Power fusebox
4 Fuse and relay unit
6 Instrument panel
8 Front left earth
10 Battery earth on engine
10A Battery earth on bodyshell
10C Battery earth for air conditioner
11 Battery
12 Ignition switch
22 Left dashboard earth
55 Front left/engine cables connection
122 Engine cooling fan low speed relay
123A Engine cooling fan high speed relay
127 Connection between front left cable/cable on relay bracket
129 Power fuse protecting engine cooling fan cables
154 Engine cooling fan
170 Resistor for engine cooling fan
195 Fuel injection/ignition electronic control unit
237 Fuse protecting Fiat CODE
307 Water temperature double sender unit
309 4-stage pressure switch
311 Connection for electric fan resistor
N.D. Ultrasound-soldered joint taped in wiring loom

4F14AN

**55** Front left/engine cables connection

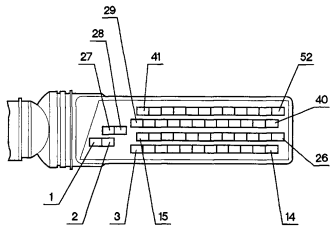



**127** Connection between front left cable/cable on relay bracket




**195A** Fuel injection/ignition electronic control unit

| | | | |
|---|---|---|---|
| 4 | L 6A | 28 | N 10B |
| 9 | LN 141 | 29 | RN n.d. |
| 13 | GV 131B | 36 | A 309 • |
| 14 | G 127 • | 40 | CL 127 • |
| 15 | SB 150 | 41 | RV 127 |
| 20 | L 141 | 47 | C n.d. |
| 21 | AR 309 • | 48 | S 309 |
| 25 | BR 139 | 50 | HM n.d. |
| 26 | LN 6A | 52 | RG 13 |
| 27 | N 10B | | |




* The cables involved in the wiring diagram are marked with an asterisk.

P4F507N02

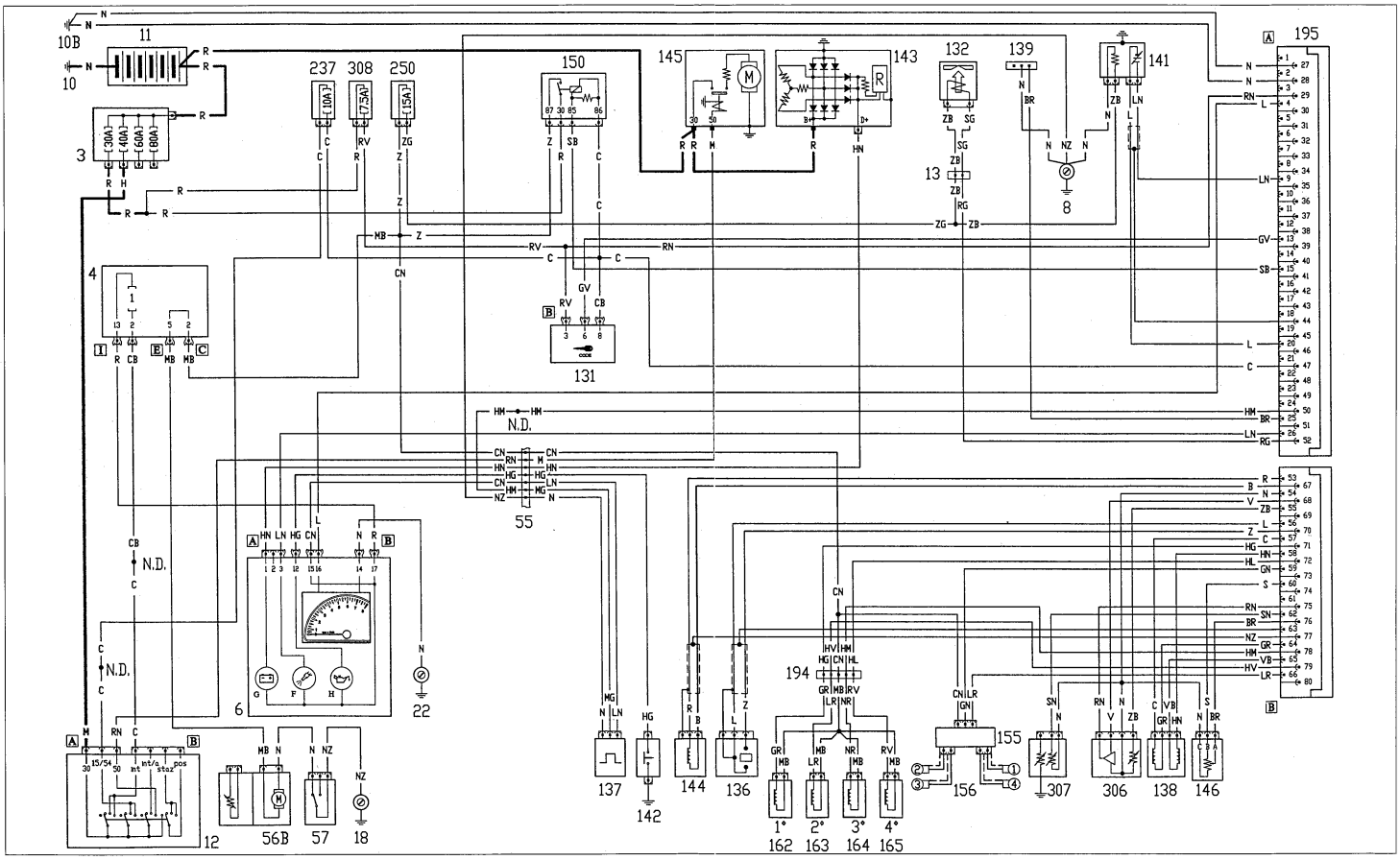
4F15AN



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# 55.

**Starter - Electronic ignition and fuel injection - Recharging and warning light - Low engine oil pressure warning light - Fuel injection fault warning light**

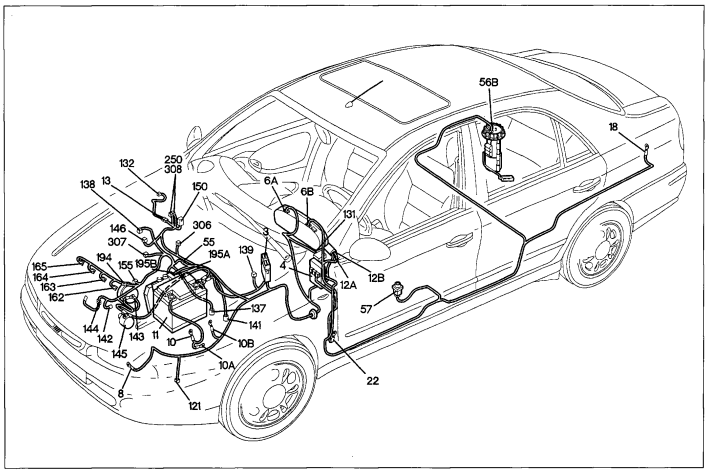



4F19AN

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P4F511N01

**Starter - Electronic ignition and fuel injection - Recharging and warning light - Low engine oil pressure warning light - Fuel injection fault warning light**

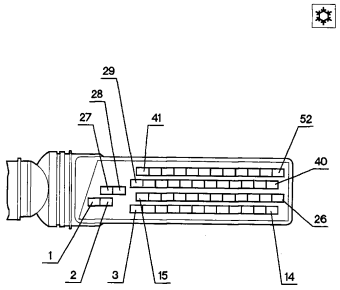
**Key to components**

3 Power fusebox
4 Fuse and relay unit
6 Instrument panel
8 Front left earth
10 Battery earth on engine
10A Battery earth on bodyshell
10B Battery earth for fuel injection
11 Battery
12 Ignition switch
13 Front right/left cables connection
18 Rear left earth
22 Left dashboard earth
55 Front left/engine cables connection
56 Fuel gauge sender unit
57 Inertial switch
131 Fiat CODE electronic control unit
132 Petrol vapours cut-off solenoid
136 Knock sensor
137 Vehicle speed sensor
138 Idle speed adjustment actuator
139 Diagnostic socket for fuel injection
141 Heated Lambda probe
142 Low oil pressure warning light switch
143 Alternator
144 Rpm and TDC sensor
145 Starter motor
146 Potentiometer on throttle valve
150 Fuel injection relay
155 Ignition coils assembly
162 Injector (1st)
163 Injector (2nd)
164 Injector (3rd)
165 Injector (4th)
194 Fuel injection cables/injector flange connection
195 Fuel injection/ignition electronic control unit
237 Fuse protecting Fiat CODE
250 Fuse protecting fuel pump
306 Integrated air temperature/pressure sender unit
307 Water temperature double sender unit
308 Fuel injection and CODE fuse

N.D. Ultrasound-soldered joint taped in wiring loom

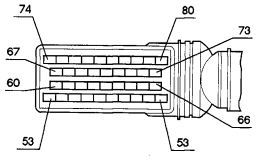
4F21AN

**195A** Fuel injection/ignition electronic control unit




| | | | |
|---|---|---|---|
| 4 | L 6A • | 28 | N 10B • |
| 9 | LN 141 • | 29 | RN n.d. • |
| 13 | GV 131B • | 35 | A 309 |
| 14 | G 127 | 40 | CL 127 |
| 15 | SB 150 • | 41 | RV 127 |
| 20 | L 141 • | 47 | C n.d. • |
| 21 | AR 309 | 48 | S 309 |
| 25 | BR 139 • | 50 | HM n.d. • |
| 26 | LN 6A • | 52 | RG 13 • |
| 27 | N 10B • | | |

**195B** Fuel injection/ignition electronic control unit




| | | | |
|---|---|---|---|
| 53 | R 144 • | 67 | B 144 • |
| 54 | N n.d. • | 68 | V 306 • |
| 55 | ZB 306 • | 70 | Z 136 • |
| 56 | L 136 • | 71 | HG 194 • |
| 57 | C 138 • | 72 | HL 194 • |
| 58 | HN 138 • | 75 | RG 306 • |
| 59 | GN 155 • | 76 | BR 146 • |
| 60 | S 146 • | 77 | NZ n.d. • |
| 62 | SN 307 • | 78 | HM 194 • |
| 64 | GR 138 • | 79 | HV 194 • |
| 65 | VB 138 • | | |
| 66 | LR 155 • | | |

P4F511N02

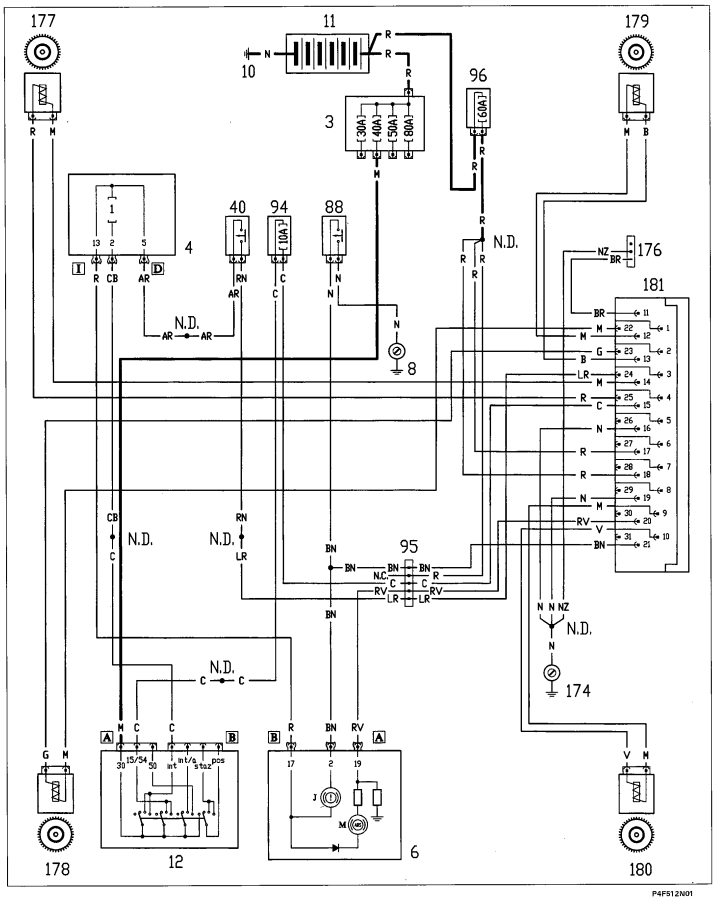
* The cables involved in the wiring diagram are marked with an asterisk.

4F22AN



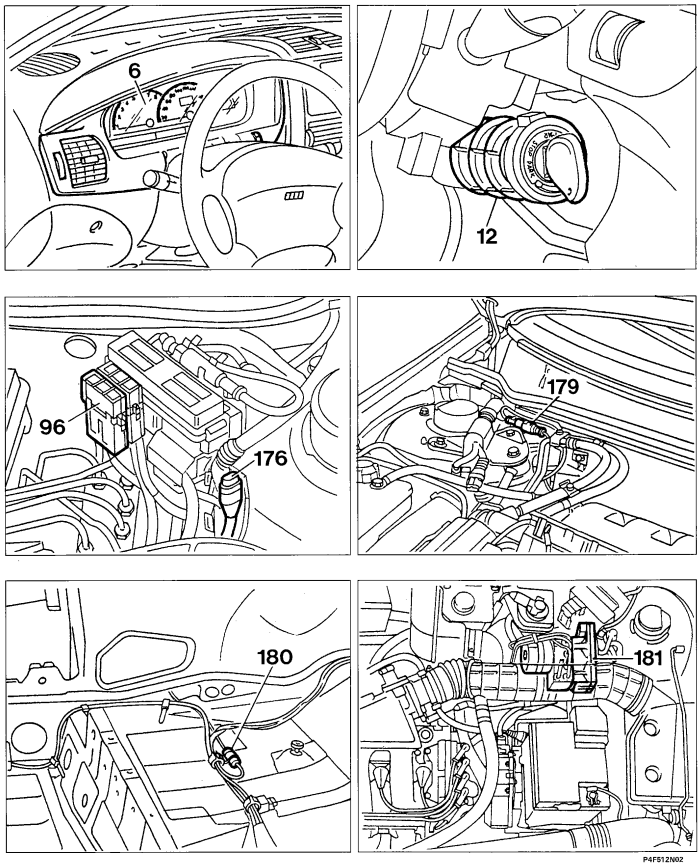
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**Anti-lock braking system (A.B.S.) and fault warning light**




4F23AN

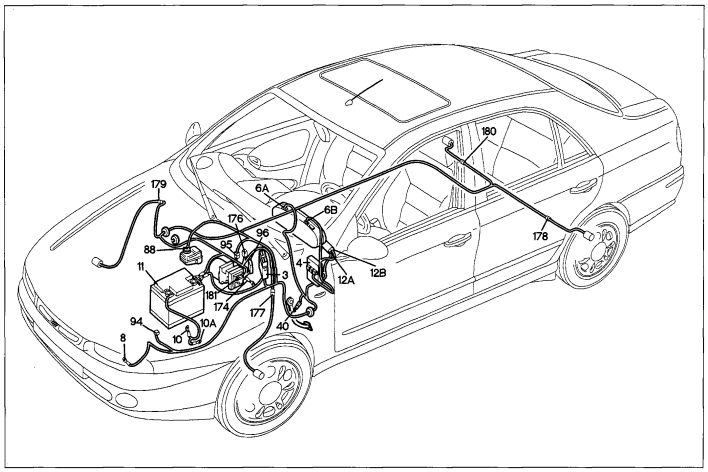
**Location of components**




4F24AN



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P4F813N01

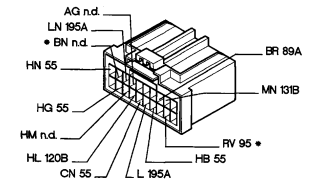
**Anti-lock braking system (A.B.S.) and warning light**

**Key to components**

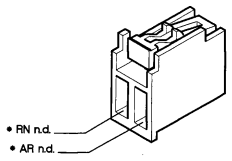
3 Power fusebox
4 Fuse and relay unit
6 Instrument panel
8 Front left earth
10 Battery earth on engine
10A Battery earth on bodyshell
11 Battery
12 Ignition switch
40 Stop lights switch
88 Low brake fluid level sensor
94 Fuse protecting anti-lock braking system (A.B.S.)
95 Connection between front cables/anti-lock braking system (A.B.S.)
96 Power fuse protecting A.B.S. electrical system
174 Power earth for anti-lock braking system (A.B.S.)
176 Diagnostic socket for anti-lock braking system (A.B.S.)
177 Sensor on front left wheel for anti-lock braking system (A.B.S.)
178 Sensor on rear left wheel for anti-lock braking system (A.B.S.)
179 Sensor on front right wheel for anti-lock braking system (A..B.S.)
180 Sensor on rear right wheel for anti-lock braking system (A.B.S.)
181 Electrohydraulic unit for anti-lock braking system (A.B.S.)

N.D. Ultrasound-soldered joint taped in wiring loom

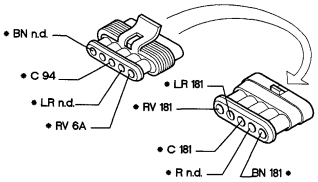
**6A** Instrument panel



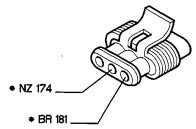

**40** Stop lights switch




**95** Connection between front cables/anti-lock braking system (A.B.S.)

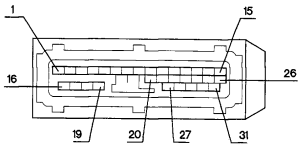



**176** Diagnostic socket for anti-lock braking system (A.B.S.)




**181** Electrohydraulic unit for anti-lock braking system (A.B.S.)

| | | | | | |
|---|---|---|---|---|---|
| 9 | M 180 • | 15 | C 95 • | 21 | BN 95 • |
| 10 | V 180 • | 16 | N n.d. • | 22 | M 178 • |
| 11 | BR 176 • | 17 | R n.d. • | 23 | G 178 • |
| 12 | M 179 • | 18 | R n.d. • | 24 | LR 95 • |
| 13 | B 179 • | 19 | N n.d. • | 25 | R 177 • |
| 14 | M 177 • | 20 | RV 95 • | | |




P4F813N02

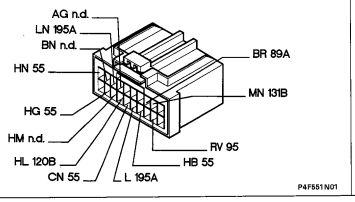
* The cables involved in the wiring diagram are marked with an asterisk.

4F25AN 4F26AN

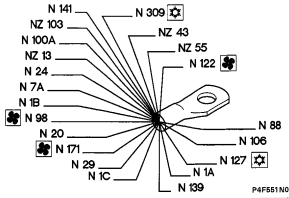


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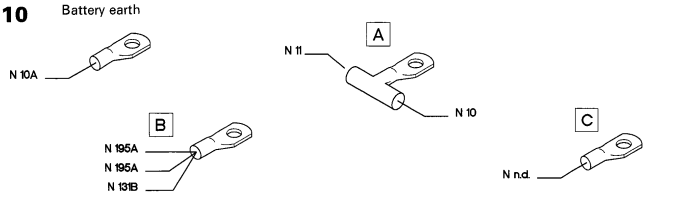
**6A** Instrument panel



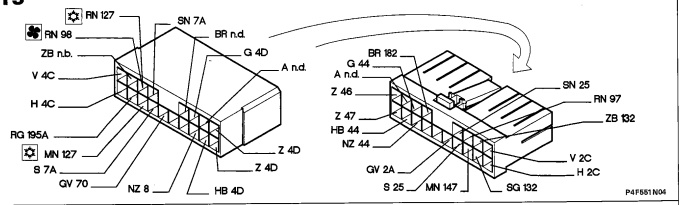

**8** Front left earth



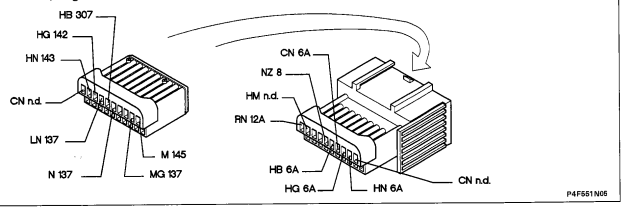

**10** Battery earth




**13** Front right/left cables connection




**55** Front left/engine cables connection





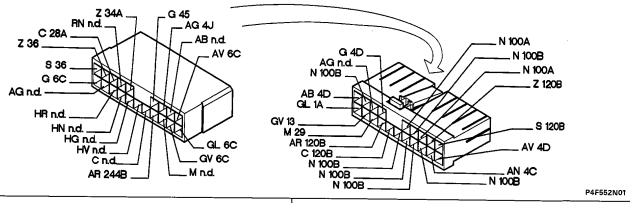

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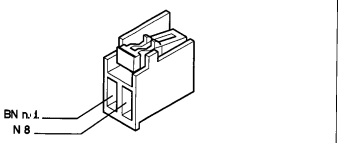
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# 55.

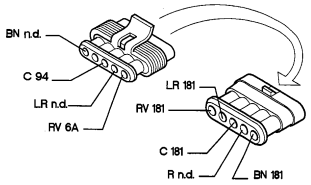
## 70 Dashboard/front cables connection




## 88 Low brake fluid level sensor

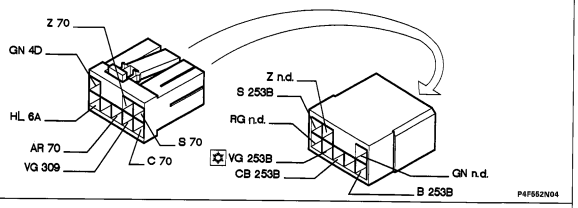



## 05 Connection between front cables/anti-lock braking system (A.B.S.)

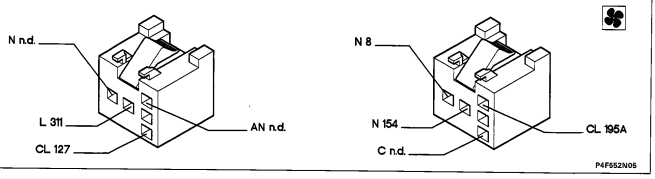



## 120B Air conditioner cables connection

AUTO




## 122 Engine cooling fan low speed relay

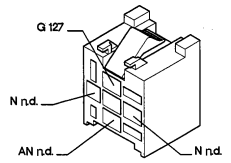



4F28AN

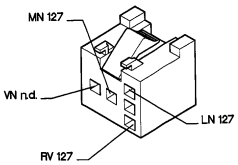


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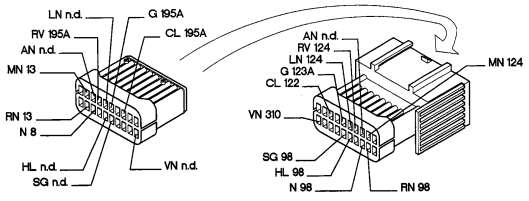
**123A** Engine cooling fan high speed relay



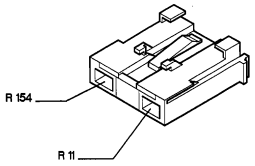

**124** Air conditioner compressor relay



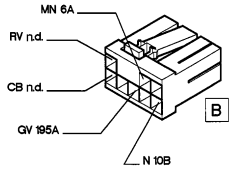

**127** Connection between front left cable/cable on relay bracket



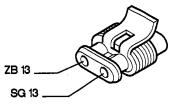

**129** Power fuse protecting engine cooling fan




**131** Fiat CODE electronic control unit




**132** Petrol vapour cut-off solenoid (canister)




4F29AN

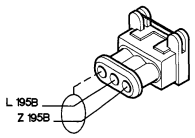
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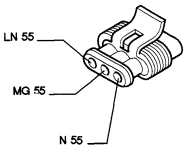
# 55.

**136** Knock sensor



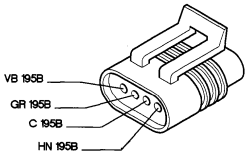

P4F554N01

**137** Vehicle speed sensor



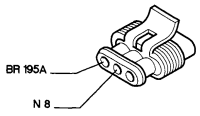

P4F554N02

**138** Idle speed actuator



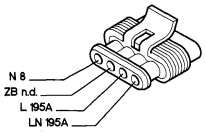

P4F554N03

**139** Diagnostic socket for fuel injection



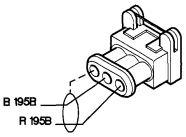

P4F554N04

**141** Heated Lambda probe



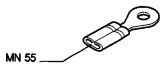

P4F554N05

**144** Rpm and TDC sensor



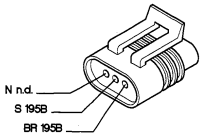

P4F554N06

**145** Starter motor




P4F554N07

**146** Potentiometer on throttle valve



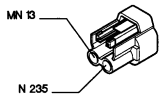

P4F554N08

4F30AN



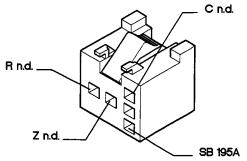
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**147** Compressor for air conditioner



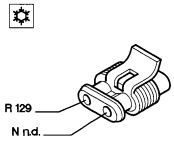

P4F555N01

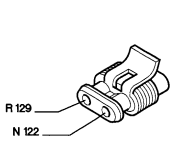
**150** Fuel injection relay




P4F555N02

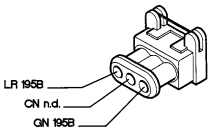
**154** Engine cooling fan



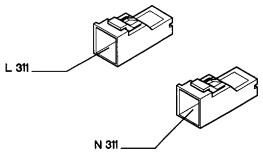

P4F555N03

**155** Ignition coils assembly



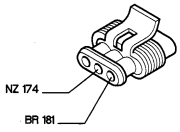

P4F555N04

**170** Resistor for engine cooling fan



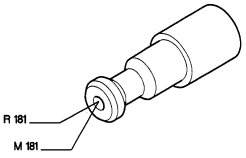

P4F555N05

**176** Diagnostic socket for anti-lock braking system (A.B.S.)




P4F555N06

**177** Sensor on front left wheel for anti-lock braking system (A.B.S.)




P4F555N07

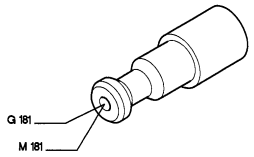
4F31AN

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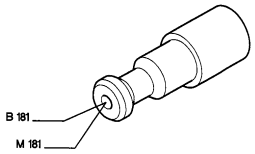


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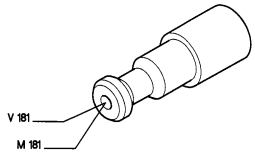
**178** Sensor on rear left wheel for anti-lock braking system (A.B.S.)




**179** Sensor on front right wheel for anti-lock braking system (A.B.S.)

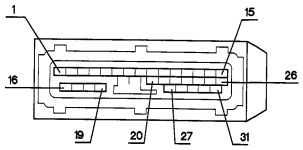



**180** Sensor on rear right wheel for anti-lock braking system (A.B.S.)

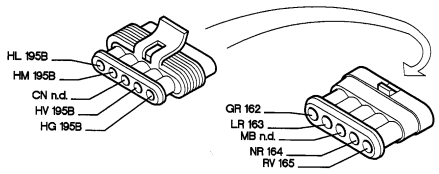



**181** Electrohydraulic unit for anti-lock braking system (A.B.S.)

| | | |
|---|---|---|
| 9 M 180 | 15 C 95 | 21 BN 95 |
| 10 V 180 | 16 N n.d. | 22 M 178 |
| 11 BR 176 | 17 R n.d. | 23 G 178 |
| 12 M 179 | 18 R n.d. | 24 LR 95 |
| 13 B 179 | 19 N n.d. | 25 R 177 |
| 14 M 177 | 20 RV 95 | |




**194** Fuel injection cables/injector flange connection



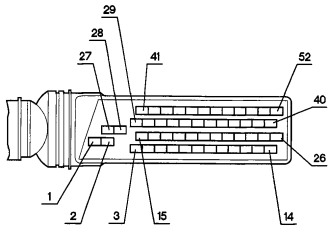

4F32AN



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## 195A Fuel injection/ignition electronic control unit (1581)

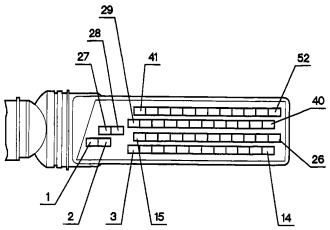
| | | | |
|---|---|---|---|
| 4 | L 6A | 28 | N 10B |
| 9 | LN 141 | 29 | RN n.d. |
| 13 | GV 131B | 35 | A 309 |
| 14 | G 127 | 40 | CL 127 |
| 15 | SB 150 | 41 | RV 127 |
| 20 | L 141 | 47 | C n.d. |
| 21 | AR 309 | 48 | S 309 |
| 25 | BR 139 | 50 | HM n.d. |
| 26 | LN 6A | 52 | RG 13 |
| 27 | N 10B | | |




P4F557N01

## 195A Fuel injection/ignition electronic control unit (1581)

| | | | |
|---|---|---|---|
| 4 | L 6A | 28 | N 10B |
| 9 | LN 141 | 29 | RN n.d. |
| 13 | GV 131B | 40 | CL 122 |
| 15 | SB 150 | 47 | C n.d. |
| 20 | L 141 | 50 | HM n.d. |
| 25 | BR 139 | 52 | RG 13 |
| 26 | LN 6A | | |
| 27 | N 10B | | |




P4F557N02

4F33AN

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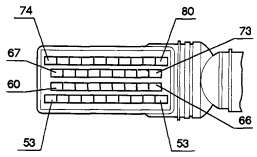


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# 55.

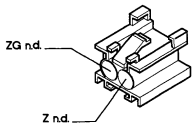
## 195B Fuel injection/ignition electronic control unit (1581)

| | | | |
|---|---|---|---|
| 53 | R 144 | 67 | B 144 |
| 54 | N n.d. | 68 | V 306 |
| 55 | ZB 306 | 70 | Z 136 |
| 55 | L 136 | 71 | HG 194 |
| 57 | C 138 | 72 | HL 194 |
| 58 | HN 138 | 76 | RG 306 |
| 59 | GN 155 | 76 | BR 146 |
| 60 | S 146 | 77 | NZ n.d. |
| 52 | SN 307 | 76 | HM 194 |
| 54 | GR 138 | 76 | HV 194 |
| 65 | VB 138 | | |
| 56 | LR 155 | | |



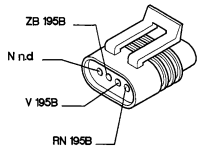

P4F558N01

## 250 Fuse protecting fuel pump



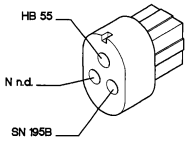

P4F558N02

## 306 Integrated air temperature/pressure sender unit



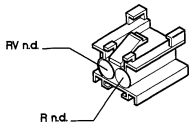

P4F558N03

## 307 Water temperature double sender unit




P4F558N04

## 308 Fuse protecting fuel injection and Code



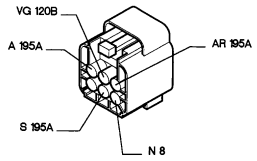

P4F558N05

4F34AN



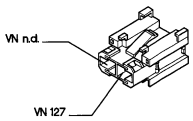
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**309** 4-stage pressure switch



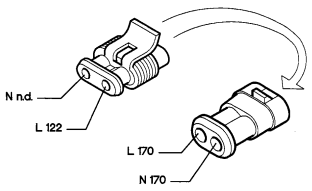

P4F558N01

**310** Fuse protecting headlamp washer and air conditioner




P4F559N02

**311** Electric fan resistor connection




P4F558N03



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| DESCRIPTION | Marea - Marea Weekend | | |
|---|---|---|---|
| | 1581 | 2387 TD | 1910 TD |
| Fuel level gauge and reserve warning light - Handbrake applied and insufficient brake fluid level warning light - Speedometer - Milometer/trip meter display and zeroing button - Engine coolant temperature gauge - Insufficient engine oil pressure warning light - Front brake pad wear warning light - Seat belt warning light | 1 | - | - |
| Fiat CODE and warning light | 3 | - | - |
| Climate control/thermostatically adjusted heater | 5 | - | - |
| Versions with climate control<br>Engine cooling - Engine coolant temperature gauge | 7 | - | - |
| Versions without climate control<br>Engine cooling - Engine coolant temperature gauge - Manually operated heater: car interior ventilation | 9 | - | - |
| Starting - Electronic injection and ignition - Recharging and warning light - Insufficient engine oil pressure warning light - Injection system failure warning light - Rev counter | 11 | - | - |
| Anti-lock brakes (A.B.S.) and failure warning light | 13 | | - |
| Instrument panel connections | - | 14/1 | - |
| Starting - Electronic injection - Recharging and warning light - Insufficient engine oil pressure warning light - Heater plugs warning light - Injection system failure warning light - Fuel pre-heating | - | 14/3 | - |
| Engine cooling (from July '98) | - | - | 14/5 |



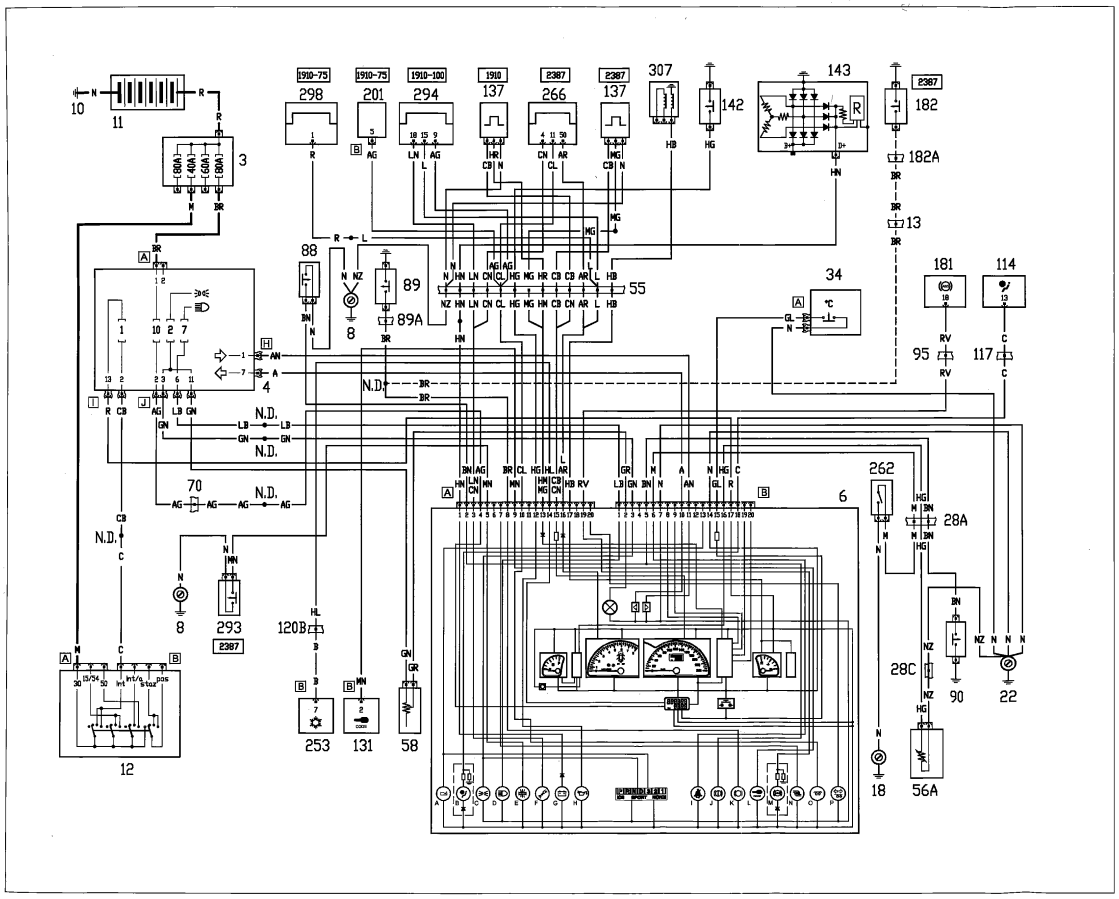
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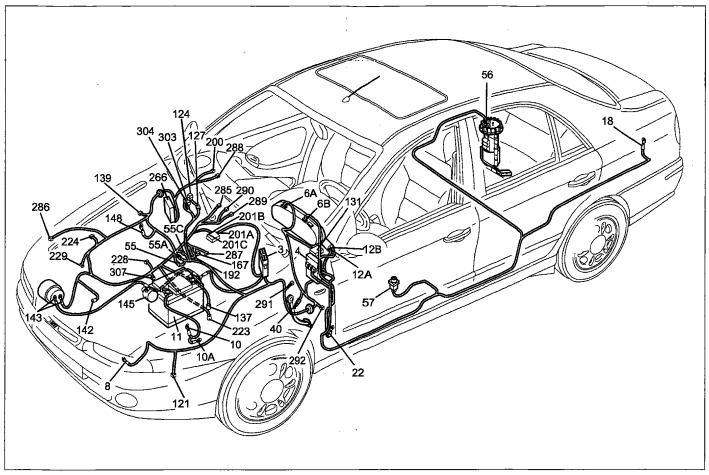
**Instrument panel connections (TD engine)**




P4F262N02



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P4F074N05

**Starting - Electronic injection - Recharging and warning light - Low engine oil pressure warning light - Heater plug warning light - Fuel injection fault warning light - Fuel preheating (2387 engine)**

**Key to components**

3 Power fuse box
4 Fuse and relay unit
6 Instrument panel
8 Front left earth
10 Battery earth on engine
10A Battery earth on body shell
11 Battery
12 Ignition switch
18 Rear left earth
22 Left dashboard earth
40 Stop lights switch
55 Front left/engine cables connection
55A Front left/engine cables connection
55C Front left/engine cables connection
56 Fuel gauge sender unit
57 Inertial switch
121 Three-stage pressure switch
124 Air conditioner compressor relay

127 Connection between front left cable/cable on relay holder bracket
131 Fiat CODE electronic control unit
137 Vehicle speed sensor
139 Diagnostic socket for fuel injection
142 Low oil pressure warning light switch

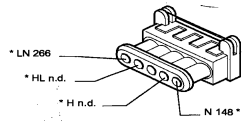
143 Alternator
145 Starter motor
148 Electronic fuel injection earth
167 Air flowmeter
192 Air temperature sensor
200 Electrostop relay (TD)
201 Heater plug control unit (TD)
223 Rpm sensor (TD)
224 Instrumented fuel injector (TD)
228 Heater plugs (TD)
229 Engine cut-out electrostop (TD)
266 Fuel injection electronic control unit (2387 TD)

285 E.G.R. solenoid (TD)
286 Diesel pump (2387 TD)
287 Solenoid on diesel pump for advance (TD)
288 Electronic fuel injection relay (TD)
289 PCT thermal contact (TD)
290 PCT heater resistor (TD)
291 Throttle pedal potentiometer (2387 TD)
292 Clutch pedal switch (2387 TD)
303 Diesel preheating fuse (TD)
304 Diesel preheating relay (TD)
307 Water temperature double sender unit

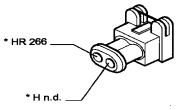
N.D. Ultrasound-soldered joint taped in wiring loom

4F266N

**167** Air flow meter

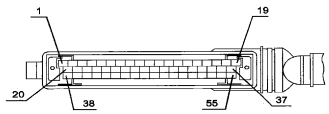



**192** Air temperature sensor

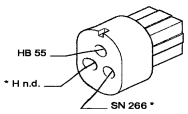



**266** Fuel injection electronic control unit ((2387)

| | | | | | |
|---|---|---|---|---|---|
| 1 | * A n.d. | 17 | * R n.d. | 42 | * HV 55 |
| 2 | * A n.d. | 18 | * N 148 | 44 | * V 55 |
| 3 | * R223 | 19 | * N n.d. | 47 | * B 223 |
| 4 | * CN 55 | 21 | * AV 286 | 50 | * AR 55 |
| 5 | * G 224 | 25 | * BL 55A | 52 | * HR 192 |
| 6 | * M 285 | 26 | * RN 55 | 53 | * SN 307 |
| 8 | * AN 201 | 27 | * AB 139 | 55 | * VN n.d. |
| 9 | * NZ 55 | 28 | * LG 55A | | |
| 10 | * AG 287 | 29 | * MG n.d. | | |
| 11 | * CL 55 | 33 | * ZB 55A | | |
| 12 | * N 224 | 35 | * MN 286 | | |
| 13 | * H n.d. | 37 | * VB 55A | | |
| 14 | * AC 286 | 38 | * LN 167 | | |
| 15 | * NZ 288 | 39 | * C 286 | | |
| 16 | * R n.d. | 41 | * HM 201 | | |




**307** Water temperature gauge double sender unit




* The wires involved in the wiring diagram are marked with an asterisk.

P4F074N06

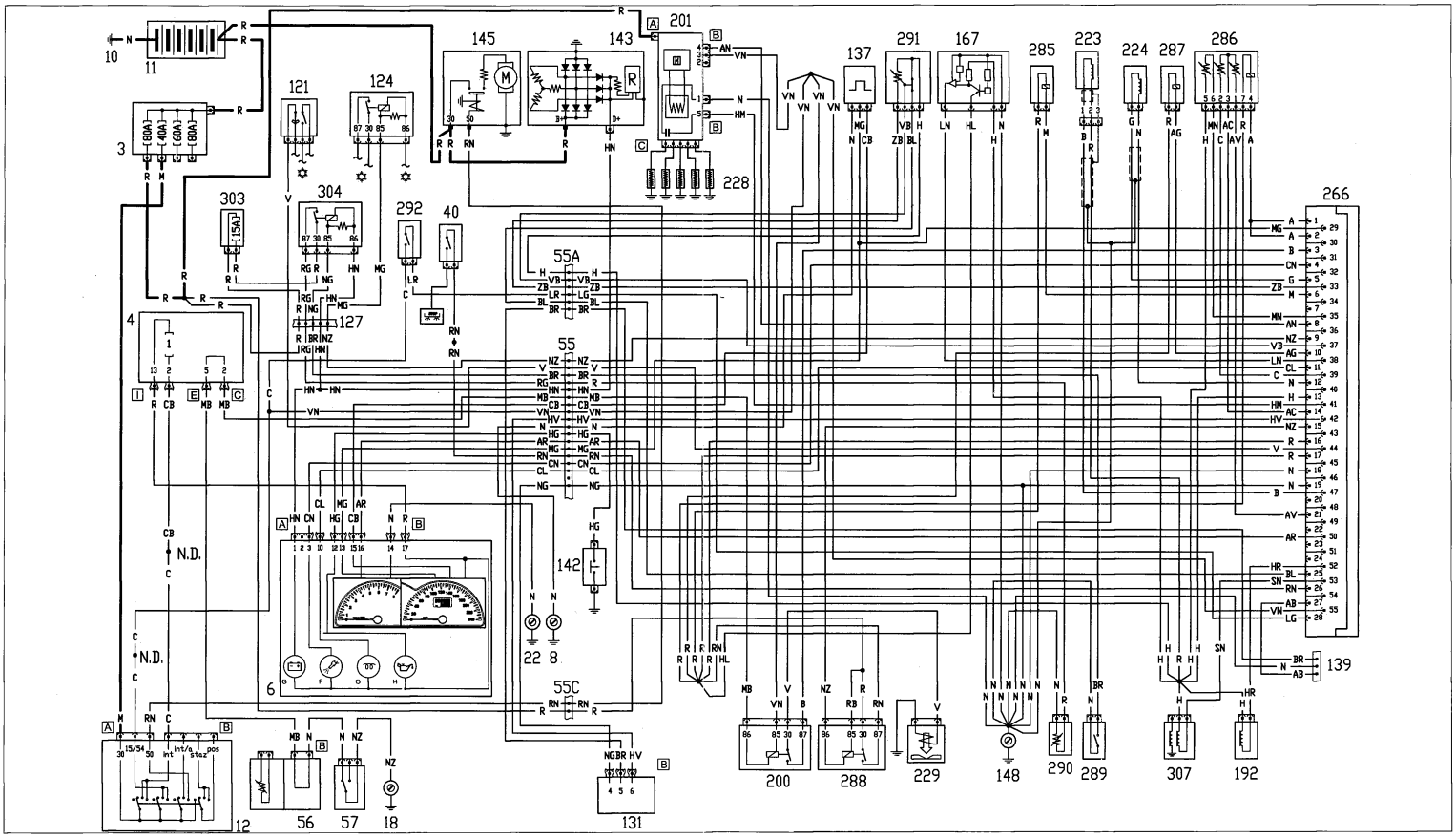
4F267N



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# 55.

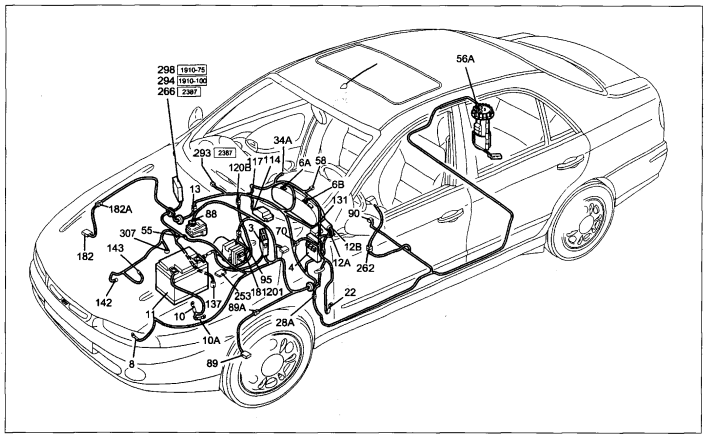
Starting - Electronic injection - Recharging and warning light - Low engine oil pressure warning light - Heater plugs warning light - Fuel injection fault warning light - Fuel preheating (2387 engine)






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# 55.




P4F074N03

**Instrument panel connections (TD engine)**

**Key to components**

3 Power fuse box
4 Fuse and relay unit
6 Instrument panel
8 Front left earth
10 Battery earth on engine
10A Battery earth on body shell
11 Battery
12 Ignition switch
13 Right/left front cable connection
22 Left dashboard earth
28 Dashboard/rear cables connection
34 Switch controls assembly
55 Front left/engine cables connection
56 Fuel gauge sender unit
58 Instrument panel brightness adjustment rheostat

70 Dashboard/front cables connection
88 Low brake fluid level sensor
89 Left brake pad wear sensor
89A Left wheel brake pad wear sensor cables connection
90 Handbrake on warning light switch
95 Front/anti-lock braking system A.B.S. cables connection
114 Air Bag electronic control unit
117 Air Bag/dashboard cables connection
120 Air conditioner cables connection
131 Fiat CODE electronic control unit

137 Vehicle speed sensor
142 Low oil pressure warning light switch

143 Alternator
158 Water temperature sensor for gauge
181 Electrohydraulic control unit for anti-lock braking system (A.B.S.)
182 Right wheel brake pad wear sensor
182A Right wheel brake pad wear sensor cables connection
201 Heater plug control unit (TD)
253 Climate control system control unit
262 Seat belts warning light switch
266 Fuel injection electronic control unit (2387)

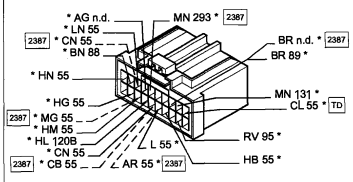
293 Air cleaner clogged indicator sensor (2387TD)

294 Fuel injection electronic control unit (1910T-D-100)
298 E.G.R. electronic control unit (1910TD-75)
307 Water temperature gauge double sender unit

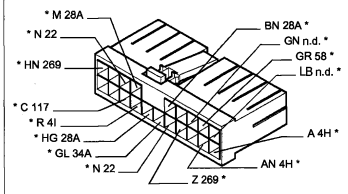
N.D. Ultrasound-soldered joint taped in wiring loom

4F263N

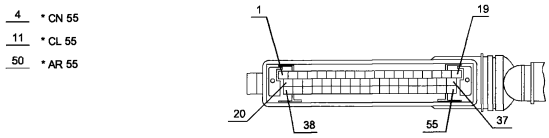
**6A** Instrument panel



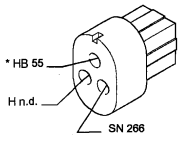

**6B** Instrument panel




**266** Fuel injection electronic control unit (2387)




**307** Water temperature gauge double sender unit




P4F074N04

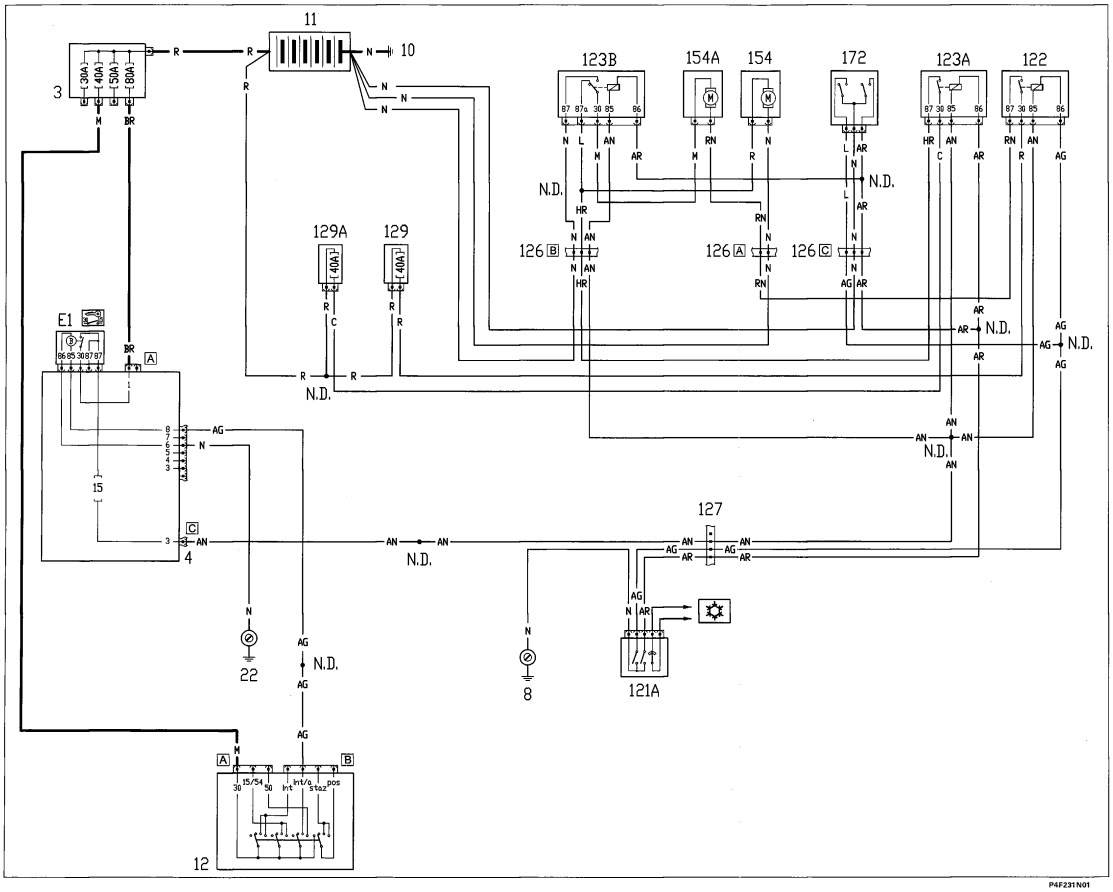
* The wires involved in the wiring diagram are marked with an asterisk.

4F264N



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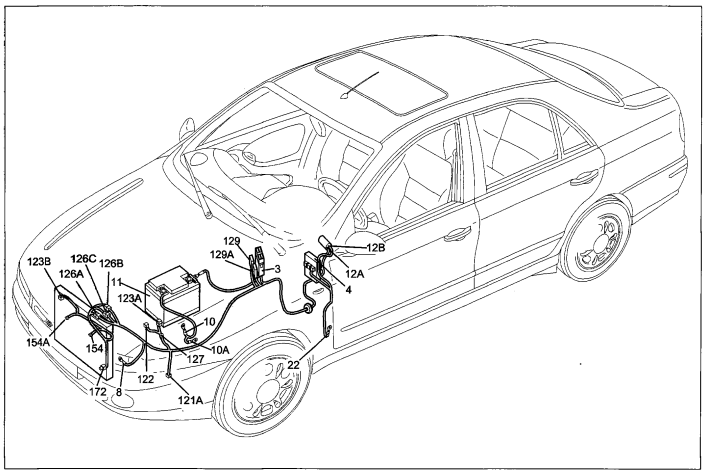
**Versions with climate control**
**Engine cooling (1910 TD engine) from July '98**






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# 55.




P4F231N03

**Versions with climate control**

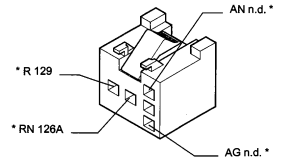
**Engine cooling - Engine coolant temperature gauge (1910 engine)**

**Components key**

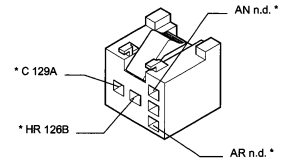
3 Power fuse box
4 Junction unit
8 Left front earth
10 Battery earth on engine
10A Battery earth on bodyshell
11 Battery
12 Ignition switch
22 Left dashboard earth
121A Four stage pressure switch
122 engine cooling fan relay - 1
123A Engine cooling fan relay - 2
123B Engine cooling fan remote control switch
126 Connection between front/radiator cables
127 Connection between left front cable/cable on relay holder bracket
129 Power fuse protecting for engine cooling fan
129A Power fuse protecting 2nd engine cooling fan
154 Engine cooling fan -1
154A Engine cooling fan - 2
172 Two level thermal switch

N.D. Ultrasound welding taped in cable loom

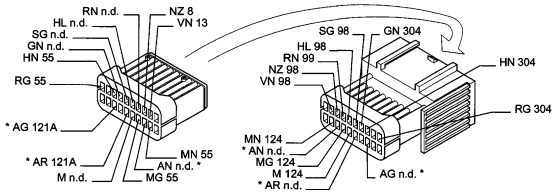
**122** Engine cooling fan relay - 1



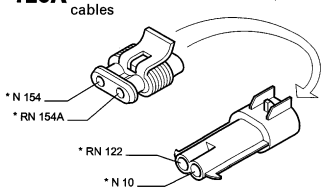

**123A** Engine cooling fan relay - 2



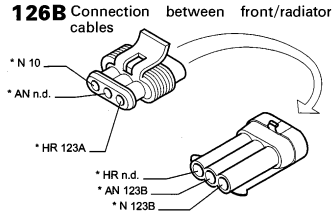

**127** Connection between left front cable/cable on relay holder bracket



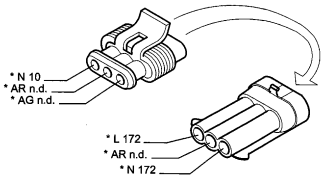

**126A** Connection between front/radiator cables




**126B** Connection between front/radiator cables




**126C** Connection between front/radiator cables




P4F231N02

* The cables in the wiring diagram, are marked with an asterisk.



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**Components key**

1 Left front light cluster
2 Right front light cluster
3 Power fuse box
4 Junction unit:
  E1 Ignition discharge relay
  E2 Horn relay feed
  E3 Heated rear windscreen relay feed
5 Dipped headlamps relay feed
6 Instrument panel:
  A Automatic transmission failure warning light
  B Air Bag system failure warning light
  C Side lights warning light
  D Main beam headlamps warning light
  E Air filter blocked warning light
  F Injection system failure warning light
  G Battery recharging warning light
  H Insufficient engine oil pressure warning light
  I Seat belt warning light
  J Handbrake applied/insufficient brake fluid level warning light
  K Brake pad wear warning light
  L Fiat CODE device failure warning light
  M Anti-lock braking system failure warning light (ABS)
  N Maximum turbocharging pressure warning light
  O Heater plugs warning light
  P Trailer lights warning light
7 Steering column switch unit:
  A Windscreen wiper speed control switch
  B Switch for windscreen washer/headlamp washer/rearscreen washer
  C Rearscreen wiper control switch
  D Flasher control
  E Switch for dipped/main beam headlamps
  F Switch for side lights
  G Intermittent device for direction indicators/-hazard warning lights
  H Switch for direction indicators
  I Horn control
8 Left front earth
9 Right front earth
0 Battery earth on engine
)A Battery earth on bodyshell
)B Battery earth for i.e.
)C Battery earth for air conditioning
1 Battery
2 Ignition switch
3 Front right/left cables connection
4 Left no. plate light bulb
5 Right no. plate light bulb
6 Left rear light cluster
7 Right rear light cluster
8 Left rear earth
9 Right rear earth
!0 Left front side direction indicator
!1 Right front side direction indicator
!2 Left dashboard earth
!3 Hazard warning lights switch unit
  A Hazard warning lights warning light
  B Hazard warning lights switch
24 Windscreen wiper motor
25 Wind/rearscreen washer electric pump
26 Rearscreen wiper motor
28 Dashboard/rear cables connection
29 Front/fog lamp cables connection
30 Left fog lamp
31 Right fog lamp
32 Fog lights relay
33 Protective fuse for fog lights
34 Switch controls:
  A Alarm on warning light
  B Rear fog lamps switch
  C Rear fog lamp relay feed
  D Rear fog lamps warning light
  E Heated rear windscreen control switch
  F Heated rear windscreen warning light
  G Switch control unit ideogram light
  H Fog lights warning light
  I Fog lights switch
35 Dashboard/left front door cables connection
36 Dashboard/right front door cables connection
39 Heated rear windscreen
40 Brake lights control switch
41 Additional brake light
42 Right dashboard earth
43 Electrical actuator for left headlamp alignment correction
44 Electrical actuator for right headlamp alignment correction
45 Headlamp alignment control unit
46 Left electric horn low tone
47 Right electric horn high tone
48 Radio receiver with clock
49 Left front speaker (tweeter)
50 Right front speaker (tweeter)
51 Speaker in left front door
52 Speaker in right front door
53 Left rear speaker
54 Right rear speaker
55 Left front/engine cables connection
55A Left front/engine cables connection
55B Right front/engine cables connection
55C Left front/engine cables connection
56 Fuel gauge assembly
  A Fuel level sensor
  B Electric fuel pump
57 Inertia switch
58 Instrument panel light dimmer
63 Thermostatic switch on radiator
64 Glove compartment light bulb with switch incorporated
65 Luggage compartment light bulb
66 Electrically adjusted external rear view mirrors control panel
67 Left external rear view mirror



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68 Right external rear view mirror
69 Cigar lighter
70 Dashboard/front cables connection
72 Protective fuse for electric front windows
73 Electric front windows control panel in left armrest
74 Right electric front window control panel in right armrest
76 Left front electric window motor
77 Right front electric window motor
78 Electric rear windows control panel in left front door
80 Electric rear windows inhibitor switch
81 Protective fuse for electric rear windows
82 Left rear electric window control panel on left rear door
83 Right rear electric window control panel on right rear door
84 Left rear electric window motor
85 Right rear electric window motor
86 Rear/left rear door cables connection
87 Rear/right rear door cables connection
88 Insufficient brake fluid level sensor
89 Left brake pad wear sensor
89A Left brake pad wear sensor cables connection
90 Switch signalling handbrake applied
91 Power relay controlled by the ignition
92 Protective fuse for electrically operated sun roof
92A Electrically operated sun roof cables connection
93A Electrically operated sun roof control unit
94 Protective fuse for anti-lock brakes A.B.S.
95 Front/anti-lock brakes cables connection A.B.S.
96 Protective power fuse for electrical equipment A.B.S.
97 Electric headlamp washer pump
98 Headlamp washer intermittent device
99 Protective fuse for headlamp washer
100 Alarm device electronic control unit
103 Diagnostic socket for alarm
105 Alarm off switch
106 Alarm switch on bonnet lid
107A Central locking remote control receiver
107B Front courtesy light
108 Left rear central locking
109 Right rear central locking
110 Left front central locking
111 Right front central locking
113 Central locking protective fuse
114 Air-bag electronic control unit
115 Passenger Air-bag
116 Driver's Air-bag
117 Air bag/dashboard cables connection
120 Air conditioning unit cables connection
121 Threee stage pressure switch
121A Four stage pressure switch
122 Engine cooling fan low speed relay
123 Engine cooling fan high speed timer
123A Engine cooling fan high speed relay
123B Engine cooling fan remote control switches
124 Air conditioning compressor relay
126 Front/radiator cables connection
127 Left front/cable on relay holder bracket connection
128 Front/radiator cables connection
129 Power fuse protecting engine cooling fan
129A Power fuse protecting 2nd engine cooling fan
130 Diagnostic socket for Air Bag
131 Fiat CODE electronic control unit
132 Petrol vapour cut out solenoid valve (canister)
133 Air Bag system protective fuse
134 Rear/heated driver's seat cables connection
134A Heated driver's seat heater pad
135 Rear/heated passenger seat cables connection
135A Heated passenger seat heater pad
136 Detonation sensor
136A Detonation sensor (1998)
137 Vehicle speed sensor
138 Idle adjustment actuator motor (1370-1581)
139 Diagnostic socket for injection system
140 Injection/ignition control unit (1370)
141 Heated Lambda sensor
142 Switch signalling insufficient engine oil pressure
143 Alternator
144 Rpm and T.D.C. sensor
145 Starter motor
146 Potentiometer on butterfly valve
147 Compressor for air conditioning
148 Earth for electronic injection
149 Instrument injector (1370)
150 Injection system relay feed (1370-1747-1998-1581)
151 Relay for Lambda sensor, electric fuel pump, injectors (1370-1998)
152 Injection system protective fuse (1581)(1747)
154 Engine cooling fan
154A Engine cooling fan
155 Ignition coils (1370-1581)
156 Spark plugs
157 Water temperature sensor for injection system

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158 Water temperature sensor for instrument
159 Reversing lights control switch
160 Injection/ignition electronic control unit (1747)
161 Ignition power module (1747)
162 Injector (1°)
163 Injector (2°)
164 Injector (3°)
165 Injector (4°)
165A Injector (5°) (1998)
166 Idle adjustment actuator (1747-1998)
167 Air flow meter
168 Timing sensor
170 Resistor for engine cooling fan
171 Heater unit cables connections
172 Two level thermal switch
174 Power earth for anti-lock brakes (A.B.S.)
176 Diagnostic socket for anti-lock braking system (A.B.S.)
177 Sensor on left front wheel for anti-lock brakes (A.B.S.)
178 Sensor on left rear wheel for anti-lock brakes (A.B.S.)
179 Sensor on right front wheel for anti-lock brakes (A.B.S.)
180 Sensor on right rear wheel for anti-lock brakes (A.B.S.)
181 Electro-hydraulic control unit for anti-lock brakes (A.B.S.)
182 Right wheel brake pad wear sensor
182A Right wheel brake pad wear sensor cables connection
183 Ignition coil (1°) (1998)
184 Ignition coil (2°) (1998)
185 Ignition coil (3°) (1998)
186 Ignition coil (4°) (1998)
187 Ignition coil (5°) (1998)
188 Ignition coil earth (1998)
189 Phase transformer (1998)
190 Injection/ignition electronic control unit (1998)
191 Phase transformer relay feed (1998)
192 Air temperature sensor
193 Earth for electronic injection (1581)
194 Injection cables/injector band connection (1581)
195 Injection/ignition electronic control unit (1581)
196 Multiple relay (1581)
197 Absolute pressure sensor (1581)
198 Protective fuse for injection/ignition control unit (1581)
199 Aerial for Fiat CODE
200 Electrostop relay feed (TD)
201 Heater plugs control unit (TD)
202 Heater unit/air conditioning controls ideogram light bulbs
206 Climate control fan

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207 Fan speed adjustment switch
208 Resistor for fan speed
209 Air intake flap control actuator
211 Frost sensor
212 Engine cooling fan relay feed (1747)
222 Earth for climate control system
223 Rpm sensor (2387)
224 Instrument injector (2387)
226 Diagnostic socket for Fiat code system (1910 TD)
227 Diagnostic socket for injection system (1747)
228 Heater plugs (TD)
229 Engine cut out electro-stop (TD)
231 Clock spring connection
232 Earth for compressor
233 Thermostatic switch on water pump (1910T-D-75)
234 Protective fuse for defrosting external rear view mirrors
235 Air conditioning compressor cables connection
236 Rear cable with tailgate connection
237 Protective fuse for FIAT CODE
238 Electric rear windows control unit
239 Air Bag/left pretensioner cable connection
240 Air Bag/right pretensioner cable connection
241 Left pretensioner
242 Right pretensioner
243 Luggage compartment light button
244 Integrated services electronic control unit
245 Rear courtesy light
247 Lambda sensor protective fuse (1370) (1998)
248 Radio controls on steering wheel
249 Diagnostic socket for climate control system
250 Fuel pump protective fuse (1370) (1747) (1998) (1581)
252 Connection between automatic transmission and engine cables
253 Climate control control unit
254 Climate control controls with passenger compartment temperature sensor
255 Electronic speed variator for climate control fan
256 Air mixture control actuator
257 Fuel pump relay feed (1747)
258 Treated air temperature sensor
259 Temperature adjustment switch
260 "MAX-DEF" microswitch
261 Tailgate locking/unlocking actuator
262 Seat belt warning light switch
263 Protective fuse for heated seats
264 Left rear courtesy light
265 Right rear courtesy light
266 Injection electronic control unit (2387)
267 Automatic transmission control unit
268 Automatic transmission connection
269 Connection between automatic transmission and dashboard cables
270 Connection between automatic transmission and rear cables

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271 Kick down switch
272 Ignition switch solenoid valve
273 Protective fuse for automatic transmission
274 Protective fuse for automatic transmission
275 Automatic transmission fluid radiator fan relay
276 Starting go ahead relay
277 Automatic transmission fluid radiator fan
278 Diagnostic socket for automatic transmission
279 Automatic transmission gear selector
280 ICE/SPORT selector for automatic transmission
281 Shift Lock solenoid valve
282 Additional PARK switch for automatic transmission
283 Safety control unit for automatic transmission
284 Automatic transmission connection on gearbox
285 E.G.R. solenoid valve (2387)
286 Electric diesel pump (2387)
287 Solenoid valve on diesel pump for advance (TD)
288 Electronic injection relay feed (TD)
289 Thermal contact PCT (TD)
290 Heater resistance PCT (TD)
291 Accelerator pedal potentiometer (2387 TD)
292 Clutch pedal switch (2387 TD)
293 Sensor signalling air filter blocked (2387TD)
294 Injection electronic control unit (1910T-D-100)
295 Protective fuse for injection (1910T-D-100)
296 Accelerator control lever potentiometer (1910TD)
297 Fast idle valve (1910TD)
298 E.G.R. electronic control unit (1910TD-75)
299 Water temperature sensor (pre-heating) (1910TD-75)
00 K.S.B. thermostatic switch (1910TD-75)
301 KSB device (1910TD-75)
302 Diagnostic socket for EGR system (1910TD-75)
303 Diesel pre-heating protective fuse (TD)
304 Diesel pre-heating protective relay (TD)
305 Compressor relay (1910TD-75)
306 Integrated air temperature/pressure sender unit
307 Twin water temperature sender unit
308 I.E. and Code protective fuse
309 4 stage pressure switch
310 Protective fuse for headlamp washer and air conditioning
311 Fan resistance connection

N.D. Ultrasound welding taped in cable loom

**Cable colour code**

| | |
|---|---|
| **A** | Light blue |
| **B** | White |
| **C** | Orange |
| **G** | Yellow |
| **H** | Grey |
| **L** | Blue |
| **M** | Brown |
| **N** | Black |
| **R** | Red |
| **S** | Pink |
| **V** | Green |
| **Z** | Violet |
| **AB** | Light blue/White |
| **AG** | Light blue/Yellow |
| **AN** | Light blue/Black |
| **AR** | Light blue/Red |
| **AV** | Light blue/Green |
| **BG** | White/Yellow |
| **BL** | White/Blue |
| **BN** | White/Black |
| **BR** | White/Red |
| **BV** | White/Green |
| **BZ** | White/Violet |
| **CA** | Orange/Light blue |
| **CB** | Orange/White |
| **CN** | Orange/Black |
| **GN** | Yellow/Black |
| **GL** | Yellow/Blue |
| **GR** | Yellow/Red |
| **GV** | Yellow/Green |
| **HG** | Grey/Yellow |
| **HN** | Grey/Black |
| **HR** | Grey/Red |
| **HV** | Grey/Green |
| **LB** | Blue/White |
| **LG** | Blue/Yellow |
| **LN** | Blue/Black |
| **LR** | Blue/Red |
| **LV** | Blue/Green |
| **MB** | Brown/White |
| **MN** | Brown/Black |
| **NZ** | Black/Violet |
| **RB** | Red/White |
| **RG** | Red/Yellow |
| **RN** | Red/Black |
| **RV** | Red/Green |
| **SN** | Pink/Black |
| **VB** | Green/White |
| **VN** | Green/Black |
| **VR** | Green/Red |
| **ZB** | Violet/White |

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page

PROTECTION AND SAFETY DEVICES

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## PROTECTION AND SAFETY DEVICES

All the vehicle supply lines were designed taking into account the most up-to-date directives in terms of safety and protection, especially to prevent fires.

There are 2 types of protection:
- active protection, aims to reduce the causes of faults "at source"
- passive protection, aims to limit the effects of a fault as much as possible

The first category includes a carefully designed wiring layout with wires positioned and carefully anchored on tracks that are repaired and protected if necessary.
The cables connected to the alternator and the motor were modified for this reason by adding protective caps etc. A strengthened sheath was also introduced for some of the more exposed sections of wiring.

The passive protection includes all interventions to reduce faults due to high current (overload, short circuit).

All system fuses were rated based on the nominal absorbtion of the loads activated at the same time, to ensure intervention in cases of a clear short circuit.

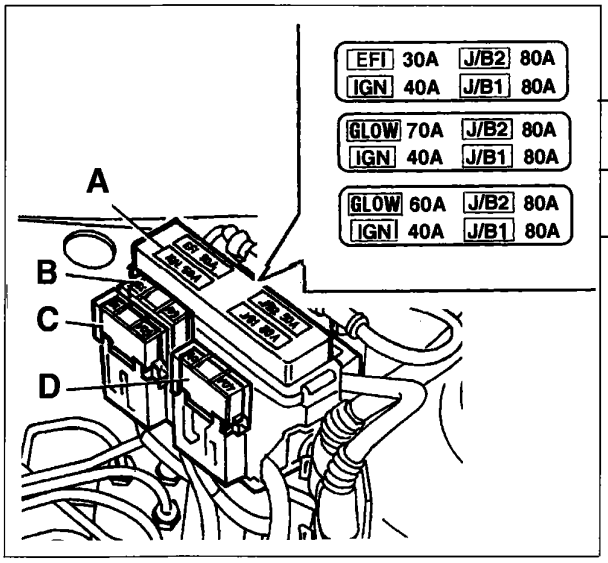
The introduction of a box containing 4 maxifuses with other fuses connected on the outside means all the supplies can be protected except for the cable that connects the battery to the starter motor and the cable that connects the starter motor to the recharging alternator. These cables are therefore protected by a strengthened supplementary sheath.

In "MAXI" fusebox **A**:

**EFI** electronic injection fuse (petrol)
**GLOW**: plug fuse (diesel)
**IGN**: ignition switch fuse
**J/B2** fuse master supply
**J/B1** fuse master supply

**N**ext to the box:

**B**: fan fuse (see table)
**C**: ABS 60A fuse
D: second fan fuse: 40**A** (for all engines TD)
**E**: electronic injection fuse (JTD): 30A




4F001GL01

All petrol engine types

2387 JTD

1910 75, 1910 JTD

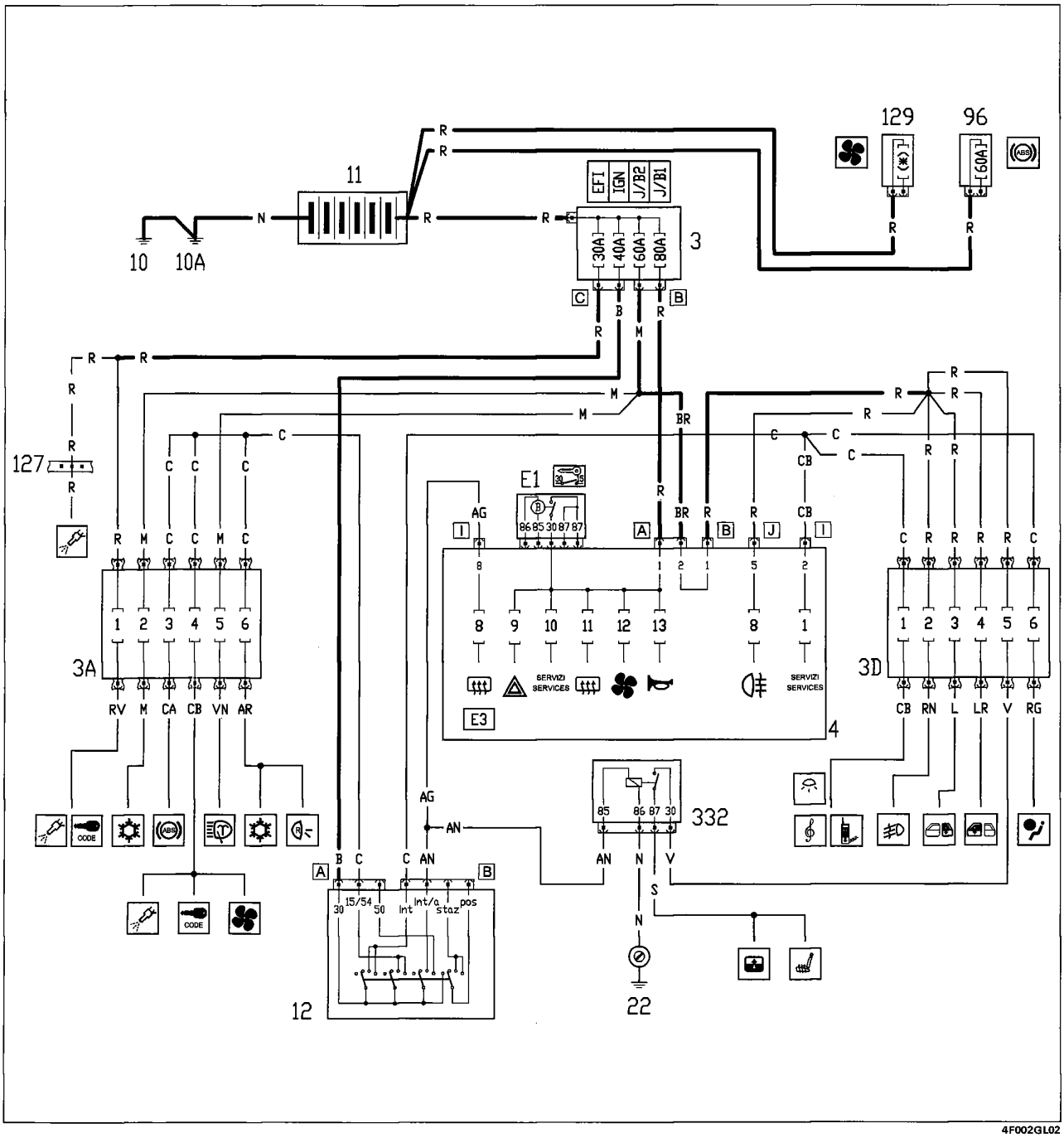
| FUSE B | |
|---|---|
| 30A | engine petrol without air conditioner |
| 40A | 1242,1581, 1747 updated. 99 with air conditioner, JTD, 1910 TD 75 |
| 50A | 1747, 1998 with air conditioner |



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# 55.

Main supplies wiring diagram (petrol engine types)




4F002GL02

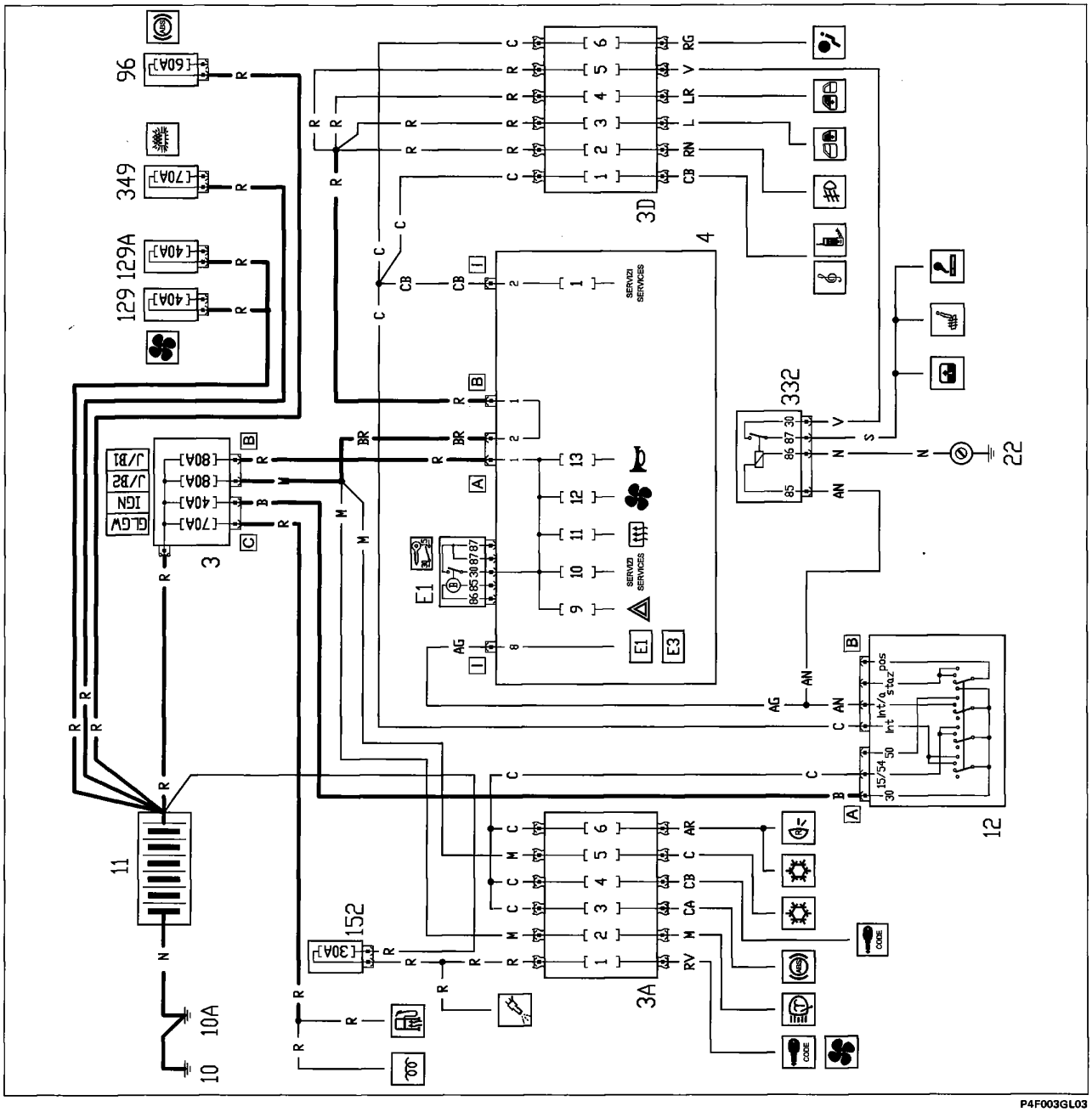
### Component key

3B/C Power fusebox
3A/D Supplementary fusebox
4 Junction unit
10 Engine battery earth
10A Bodyshell battery earth
11 Battery
12 Ignition switch
96 Power fuse protecting A.B.S
129 Engine cooling fan protection power fuse.
332 Ignition activated power relay.
(*) See table on previous page.




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## Main supplies wiring diagram (diesel engine types)




P4F003GL03

## Component key

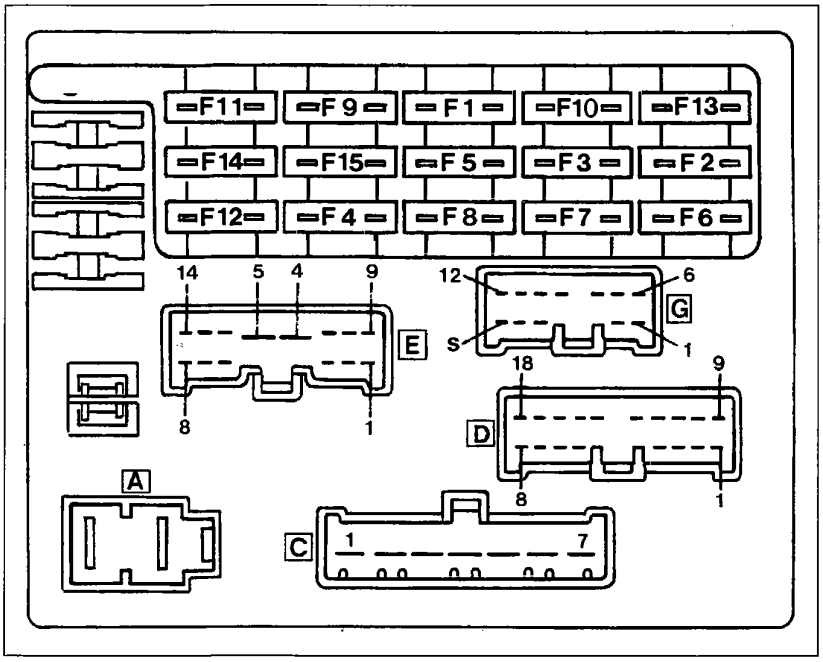
- 3B/C Power fusebox
- 3A/D Supplementary fusebox
- 4 Junction unit
- 10 Engine battery earth
- 10A Bodyshell battery earth
- 11 Battery
- 12 Ignition switch
- 96 Power fuse protecting A.B.S
- 129 Engine cooling fan protection power fuse.
- 129A Power fuse protecting engine cooling fan no.2
- 201 Heaer plugs control unit
- 332 Ignition activated power relay



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# 55.

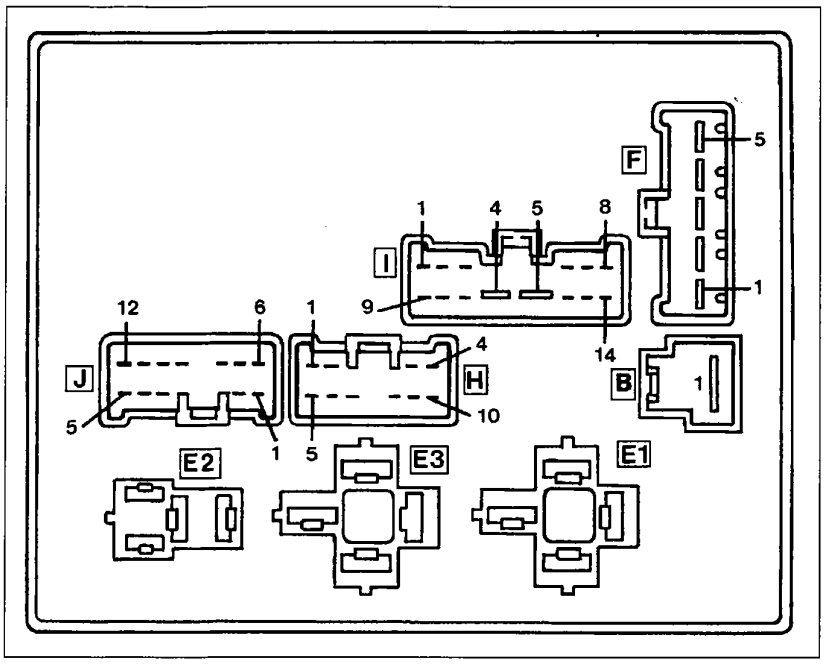
### Junction unit




4f02AL01

Front view of control unit and location of fuses.

*The connectors cannot be connected incorrectly as each has its own unique shape. The letters identifying the connectors are the same as those used in the wiring diagrams .*




4f02AL02

Rear view of control unit and location of relays.

E1. Switch discharge relay for starting (30A)
E2. Horn relay (20A)
E3. Heated rear windscreen relay (30A)

**NOTE** *connectors A, C and D: are connected to the front lead.*
*connectors B,F, I, J and H are connected to the facia lead*
*connectors E and G are connected to the rear lead*




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## DESCRIPTION OF CABLES AND CONNECTORS

| CONNECTOR A | | |
|---|---|---|
| Terminal No. | Cable colour | Circuit involved |
| 1 | R | +30 Suppply from fuse box |
| 2 | BR | +30 Supply from fuse box |

| CONNECTOR C | | |
|---|---|---|
| Terminal No. | Cable colour | Circuit involved |
| 1 | RN | Supply for vehicle interior fan (with air conditioning), air conditioning control unit |
| 2 | MB | Electric fuel pump operation, inertia switch |
| 3 | AN | Supply for vehicle interior fan (heater only), air conditioning control unit |
| 4 | H | Right dipped beam headlamp |
| 5 | HN | Left dipped headlamp, headlamp washer enablement |
| 6 | VN | Left main beam headlamp |
| 7 | V | Right main beam headlamp |

| CONNECTOR E | | |
|---|---|---|
| Terminal No. | Cable colour | Circuit involved |
| 1 | RN | Right brake light |
| 2 | GR | Rear view mirror control light |
| 3 | RG | Left brake light |
| 4 | MN | Heated rear windscreen supply |
| 5 | MB | Electric fuel pump, inertia switch |
| 6 | - | N.C. |
| 7 | AN | Left rear direction indicator |
| 8 | - | N.C. |
| 9 | GR | Right rear side light (without Check Panel) |
| 10 | HL | Left number plate light (without Check Panel) |
| 11 | - | N.C. |
| 12 | RG | N.C. |
| 13 | RN | N.C. |
| 14 | R | Additional brake light |

| CONNECTOR B | | |
|---|---|---|
| Terminal No. | Cable colour | Circuit involved |
| 1 | R | Supply for electric windows, central locking, services control unit, main beam headlamp relay, fog lights, sun roof, heated seats, cigar lighter |

| CONNECTOR D | | |
|---|---|---|
| Terminal No. | Cable colour | Circuit involved |
| 1 | G | Left headlamp alignment |
| 2 | G | Right headlamp alignment |
| 3 | G | Headlamp alignment control |
| 4 | AN | Left front and side direction indicator |
| 5 | AR | Alarm control unit supply |
| 6 | HB | Right headlamp alignment supply |
| 7 | H | Left headlamp alignment supply |
| 8 | H | Headlamp alignment control |
| 9 | B | Reversing lights control |
| 10 | Z | Horns |
| 11 | Z | Horns |
| 12 | - | N.C. |
| 13 | GV | Right front side light |
| 14 | AR | Brake lights supply |
| 15 | A | Right front and side direction indicator |
| 16 | GL | Left front side light |
| 17S | - | N.C. |
| 18 | RN | Brake lights control |

| CONNECTOR F | | |
|---|---|---|
| Terminal No. | Cable colour | Circuit involved |
| 1 | HR | Dipped headlamps control |
| 2 | - | N.C. |
| 3 | LR | Main beam headlamps control |
| 4 | - | N.C. |
| 5 | G | Supply for side lights controlled by ignition |



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### DESCRIPTION OF CABLES AND CONNECTORS (cont')

| CONNECTOR G | | |
|---|---|---|
| Terminal No. | Cable colour | Circuit involved |
| 1 | HB | Right number plate light (without Check Panel) |
| 2 | - | N.C. |
| 3 | AR | Rear view mirror's supply |
| 4 | - | N.C. |
| 5 | A | Right rear direction indicator |
| 6 | BN | Left reversing light (Marea only) |
| 7 | B | Right reversing light |
| 8 | GN | Left rear side light (without Check Panel) |
| 9 | RG | Rear courtesy light supply (left for Marea Weekend) |
| 10 | RN | Remote control receiver supply |
| 11 | RN | Front courtesy light supply |
| 12 | RN | Right rear courtesy light supply (Marea Weekend) |

| CONNECTOR I | | |
|---|---|---|
| Terminal No. | Cable colour | Circuit involved |
| 1 | AN | Hazard warning lights supply |
| 2 | CB | +15 Supply controlled by ignition |
| 3 | - | N.C. |
| 4 | CB | Steering column switch unit supply |
| 5 | C | Supply, windscreen wiper |
| 6 | N | Earth |
| 7 | LN | Horn signal |
| 8 | AG | +15 Supply controlled by ignition (excluding starting) |
| 9 | AB | Hazard warning lights supply |
| 10 | AB | Hazard warning lights supply |
| 11 | AB | Hazard warning lights supply |
| 12 | AR | Direction indicators supply |
| 13 | R | Instrument panel supply |
| 14 | - | N.C. |

| CONNECTOR H | | |
|---|---|---|
| Terminal No. | Cable colour | Circuit involved |
| 1 | AN | Right direction indicator warning light |
| 2 | C | Supply, central locking, radio |
| 3 | AN | Right direction indicator control |
| 4 | RN | Right brake light (versions with Check Panel) |
| 5 | A | Left direction indicator control |
| 6 | A | Left direction indicator control |
| 7 | A | Left direction indicator warning light |
| 8 | AN | Right direction indicator control |
| 9 | RV | Brake lights control (versions with Check Panel) |
| 10 | MN | Mirror demisting control |

| CONNECTOR J | | |
|---|---|---|
| Terminal No. | Cable colour | Circuit involved |
| 1 | RG | Left brake light (versions with Check Panel) |
| 2 | AG | Supply for alarm and instrument panel |
| 3 | GN | Side lights warning light, switch panel light, automatic transmission controls light |
| 4 | BC | Heated rear windscreen control |
| 5 | R | Supply, radio |
| 6 | LB | Main beam headlamps warning light |
| 7 | RV | Radio phone supply |
| 8 | - | N.C. |
| 9 | R | Radio supply |
| 10 | GN | Radio light |
| 11 | GN | Instrument panel light dimmer |
| 12 | GN | Cigar lighter light |




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## LIST OF FUSES AND MAJOR PROTECTED CIRCUITS

| Fuse No. | Amp | Ideogram | Protected circuit | Fuse No. | Amp | Ideogram | Protected circuit |
|---|---|---|---|---|---|---|---|
| 1 | 10(*) | SERVIZI SERVICES | Brake lights – Additional brake light – Direction indicators – Instrument supply | 6 | 10 |  | Right main beam headlamp |
| 2 | 10 |  | Right front side light – Left rear side light – Right number plate light – Radio light – Instrument pane light dimmer – Side lights warning light – Cigar lighter light – Switch panel light – Automatic transmission controls light – Radio phone light – Heater/air conditioning controls light. | 7 | 10 |  | Left main beam headlamp – Main beam headlamps warning light. |
| | | | | 8 | 20 |  | Central locking – Luggage compartment light |
| | | | | 9 | 10 |  | Hazard warning lights. |
| | | | | 10 | 10 | SERVIZI SERVICES | Interior lights (front and rear) – Instrument supply – Remote control receive and alarm control unit supply – Radio phone supply |
| 3 | 10 |  | Left front side light – Right rear side light – Left number plate light – Mirror controls light | 11 | 30 |  | Heated rear windscreen – Mirror demisting |
| | | | | 12 | 30 |  | Car interior climate control fan motor (air conditioning) |
| | | | | | | | Air conditioning control unit |
| 4 | 10 |  | Right dipped beam headlamp | 13 | 20 |  | Horns |
| | | | | 14 | 20 |  | Windscreen wiper – Rearscreen wiper – Windscreen/rearscreen washer – Headlamp washer enablement |
| 5 | 10 |  | Left dipped headlamp – Headlamp alignment corrector – Headlamp washer enablement. | 15 | 20 |  | Air conditioning control unit – Vehicle interior fan motor (with heater) |

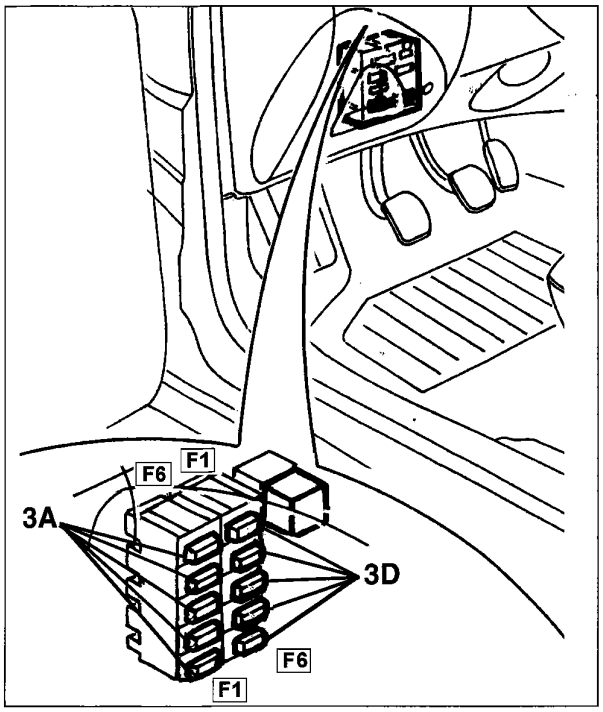
(*) Replaced with 15A if the tow hook is fitted



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# 55.

## SUPPLEMENTARY FUSEBOX




4F006GL02

Many shunt fuses are found under the facia just above the junction control unit

The fuses are grouped in two special multiple connectors, one for the front wiring the other for the facia wiring, according to a pre-set position and located as shown in the figure.

### 3A: front wiring

| Fuse | Protected circuit | Amp |
|---|---|---|
| - F1 | Fuse protecting injection memory and CODE | 7.5 |
| - F2 | Fuse protecting compressor and air conditioner | 7.5 |
| - F3 | Fuse protecting ABS | 10 |
| - F4 | Fuse protecting injection and CODE | 7.5 |
| - F5 | Fuse protecting headlamp washers | 20 |
| - F6 | Fuse protecting ignition activated services (15/54) | 7.5 |

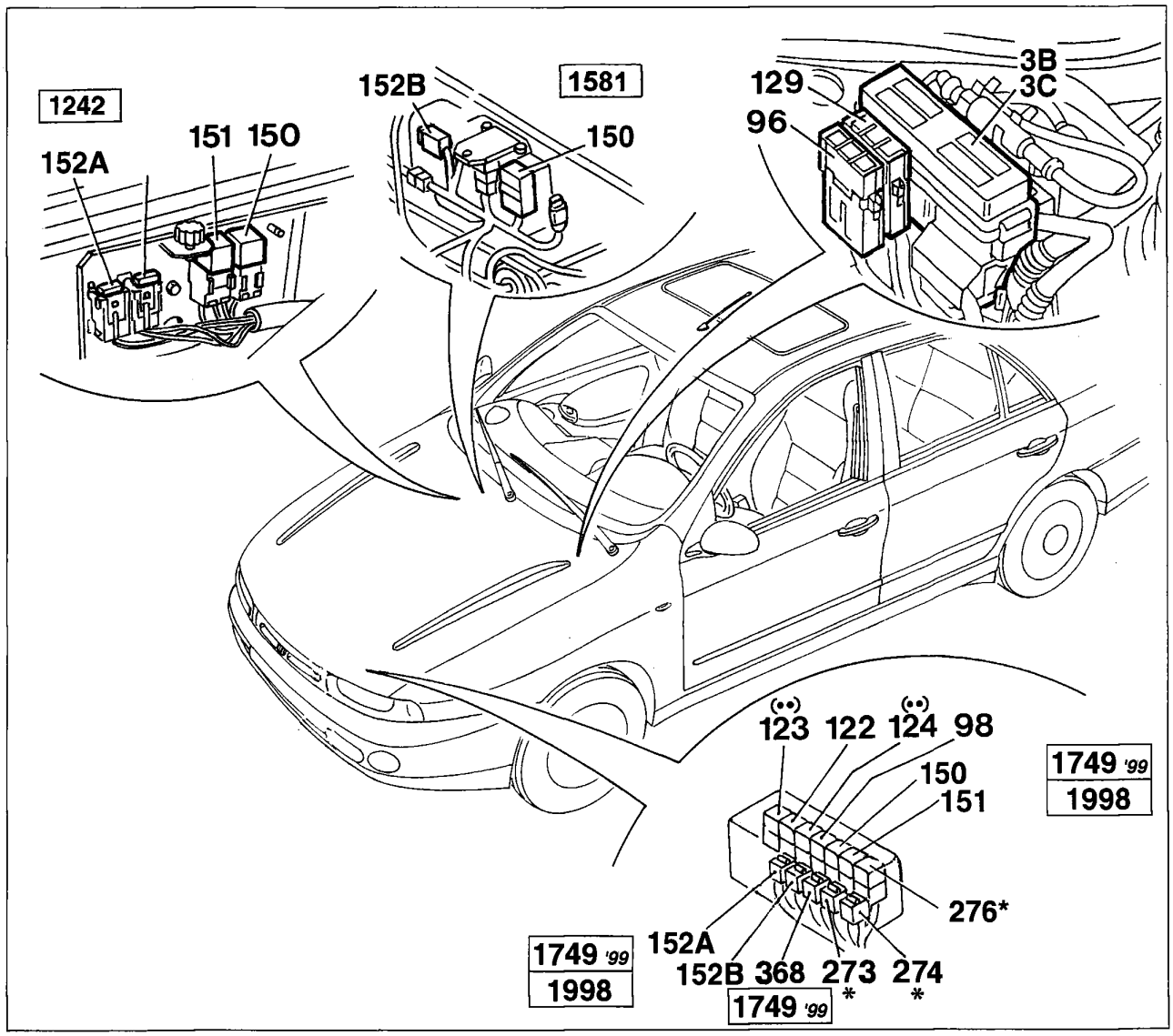
### 3D: facia wiring

| Fuse | Protected circuit | Amp |
|---|---|---|
| - F1 | Fuse protecting ignition activated services (INT) | 7.5 |
| - F2 | Fuse protecting foglamps | 15 |
| - F3 | Fuse protecting rear electric windows | 25 |
| - F4 | Fuse protecting front electric windows | 25 |
| - F5 | Fuse protecting sun roof, seats, cigar lighter | 30 |
| - F6 | Fuse protecting airbag | 10 |



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## LOCATION OF RELAYS AND FUSES ON THE VEHICLE (BONNET - Petrol engine types )




4F007GL01

3B-3C Power fusebox
96 Power fuse protecting ABS
98 Headlamp washer intermittent function
122 Engine cooling fan low speed relay
123 Engine cooling fan high speed timer
124 Air condiitoning compressor control relay
129 Power fuse protecting engine coling fan
150 Injection system relay feed
151 Lambda probe control relay for fuel pump and injectors
152 Fuse protecting injection system
152A Fuse protecting injection system
152B Fuse protecting injection system
273 Fuse protecting automatic transmission system
274 Fuse protecting automatic transmission system
276 Starter enablement relay
368 Relay diode for injection system control

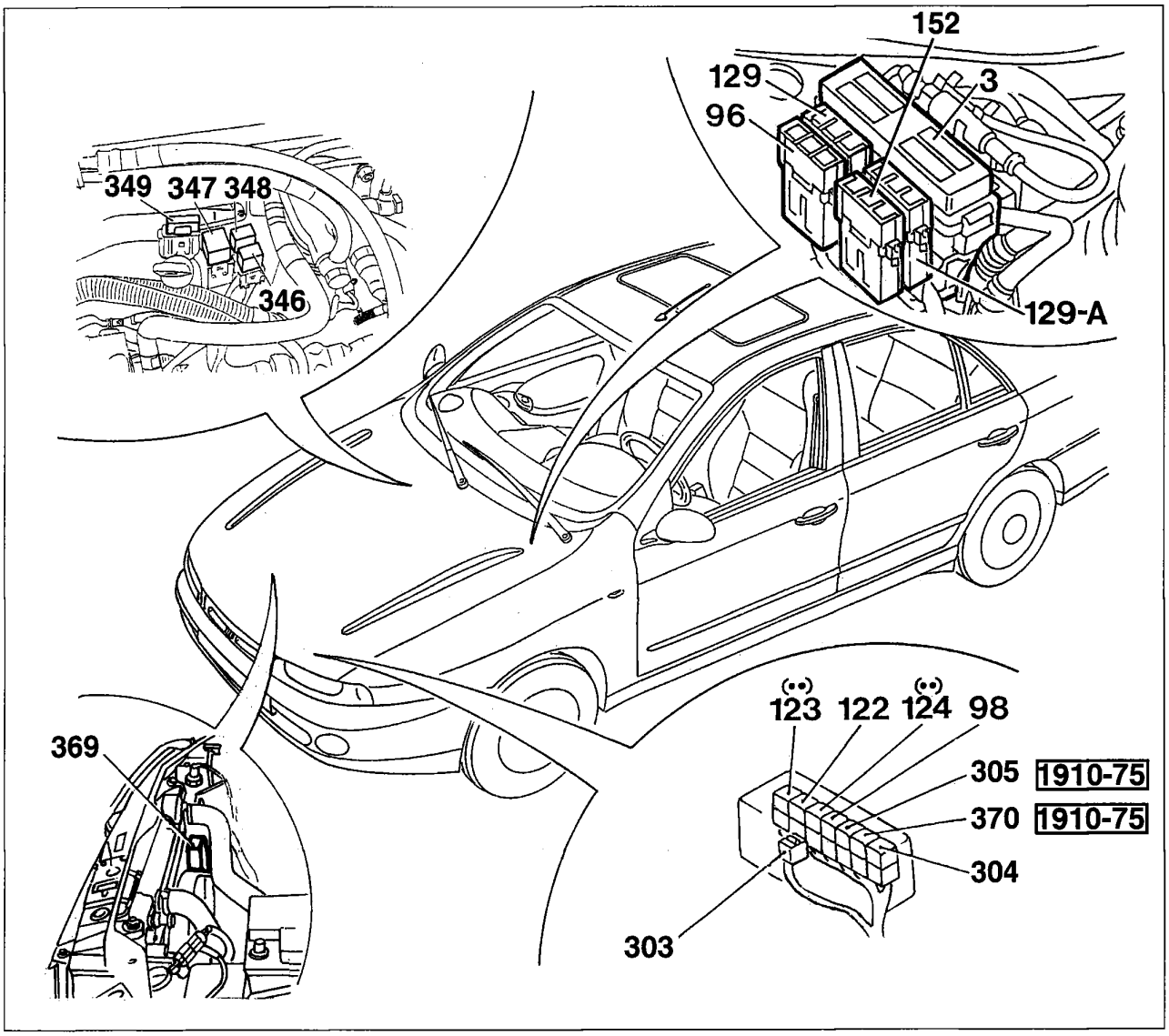
(••) Versions with air conditioning
(*) 1581 with automatic transmission.



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# 55.

LOCATION OF RELAYS AND FUSES ON THE VEHICLE (BONNET - Diesel engine types )




4F008GL01

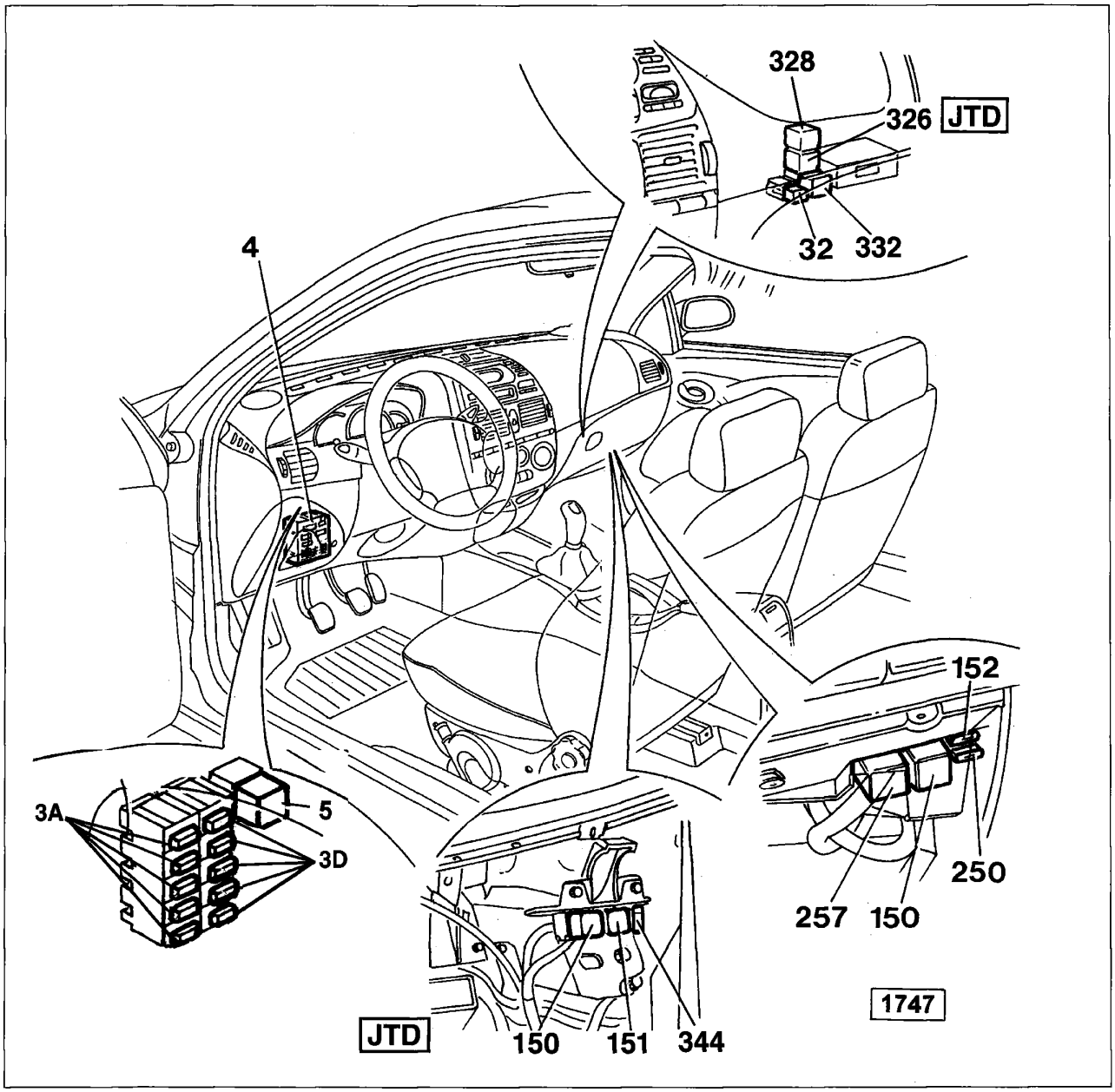
3B/C Power fusebox
96 Power fuse protecting A.B.S
98 Headlamp washer intermittent function
122 Engine cooling fan low speed relay
123 Engine cooling fan high speed timer
124 Air condiitoning compressor control relay
129 Engine cooling fan protection power fuse
129A Power fuse protecting engine cooling fan no. 2
152 Fuse protecting injection system
303 Fuse protecting diesel preheater (TD)
304 Diesel preheating protection relay.
305 Compressor disconnection relay (1910 TD-75)
346 Additional heater relay
347 Additional heater relay
348 Additional heater remote control swictch
349 Additional heater protective fuse
369 Engone cooling fan remote control switch
370 Inertia switch relay (1910 TD-75)

(••) Versions with air conditioning




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## LOCATION OF RELAYS AND FUSES ON THE CAR (PASSENGER COMPARTMENT)




P4F009GL02

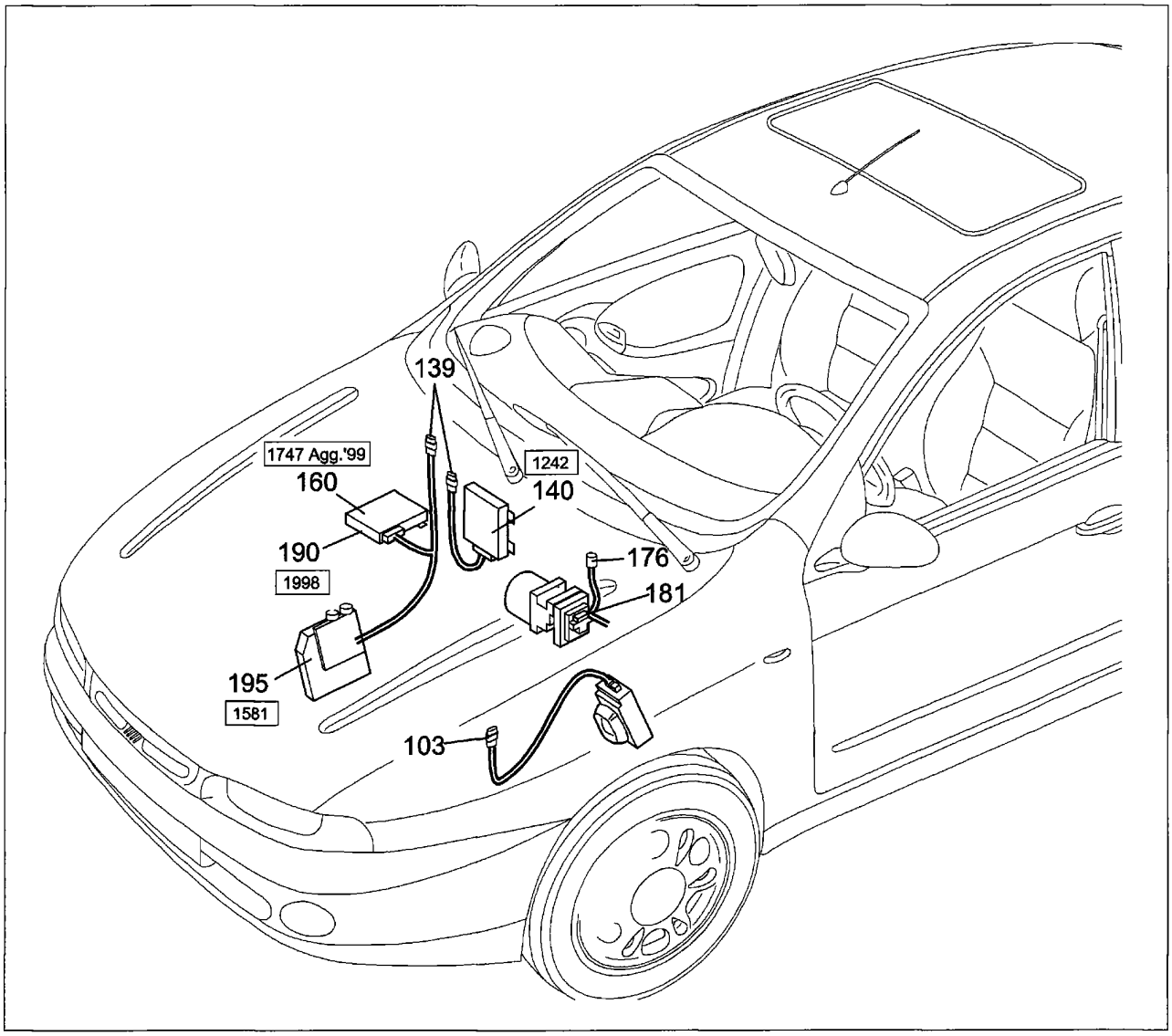
3A/D Supplementary fusebox
4 Junction unit
5 Dipped headlamps relay feed
32 Fog lamp control relay
150 Injection sytem control relay (1747) (JTD)
151 Lambda probe control relay for fuel pump and injectors
152 Fuse protecting injection system (1747) (JTD)
250 Fuse protecting fuel pump (1747)
257 Fuel pump control relay (1747)
326 Additional heater control unit
328 Hazard warning lights relay
332 Ignition activated power relay.
344 Protection fuse ie. (JTD)



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# 55.

## LOCATION OF CONTROL UNITS AND TESTING SOCKETS (BONNET - petrol engine types)



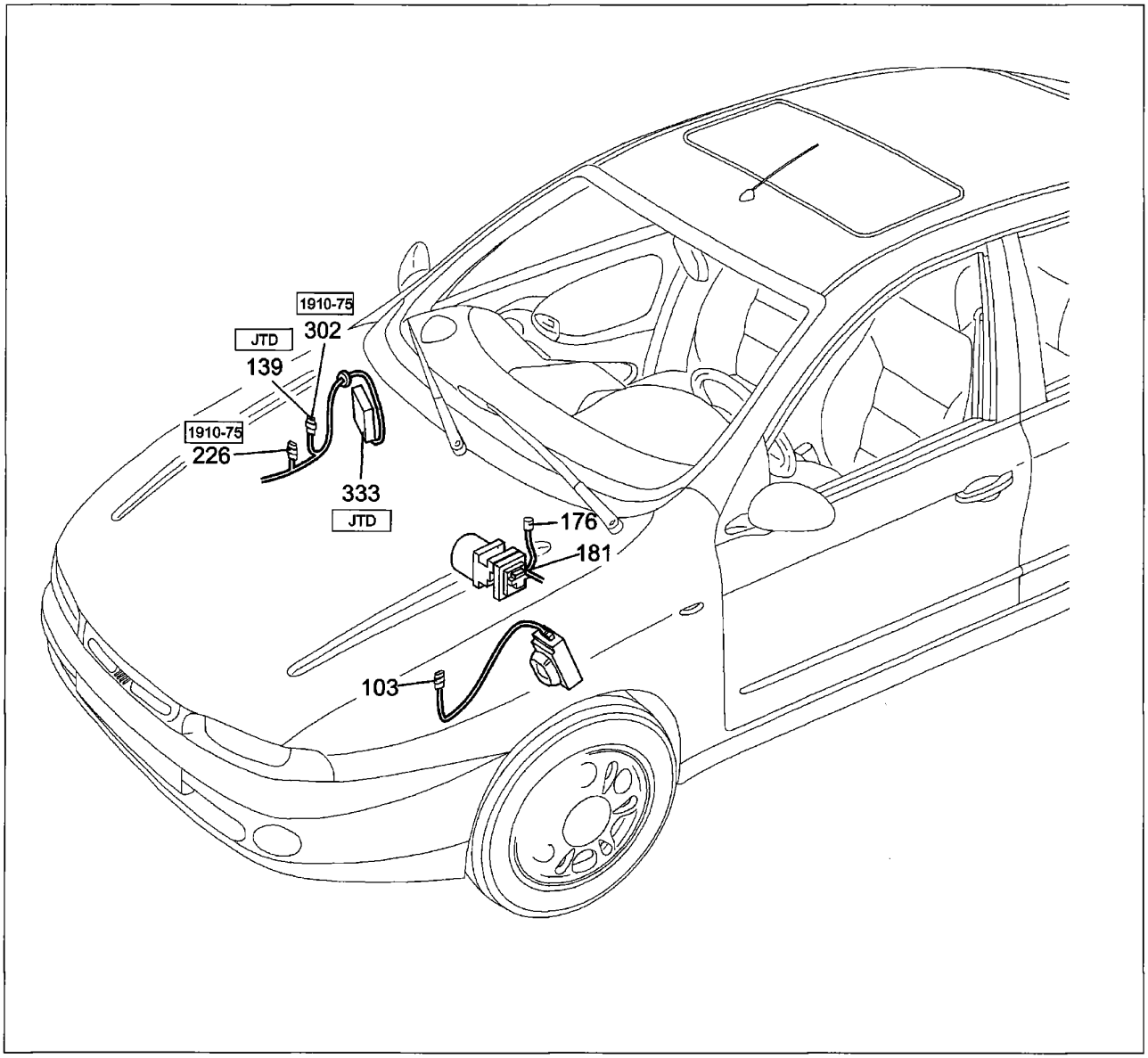

4F010GL01

100 Alarm electronic control unit
103 Tester socket for injection alarm
139 Tester socket for injection system
140 Injection/ignition control unit (1242)
160 Injection/ignition control unit (1747)
176 Diagnostic socket for anti-lock brakes (A.B.S.)
181 Electro-hydraulic control unit for anti-lock brakes (A.B.S.)
190 Injection/ignition control unit (1998)
195 Ignition/injection control unit (1581)




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## LOCATION OF CONTROL UNITS AND TESTING SOCKETS (BONNET - diesel engine types)




4F011GL01

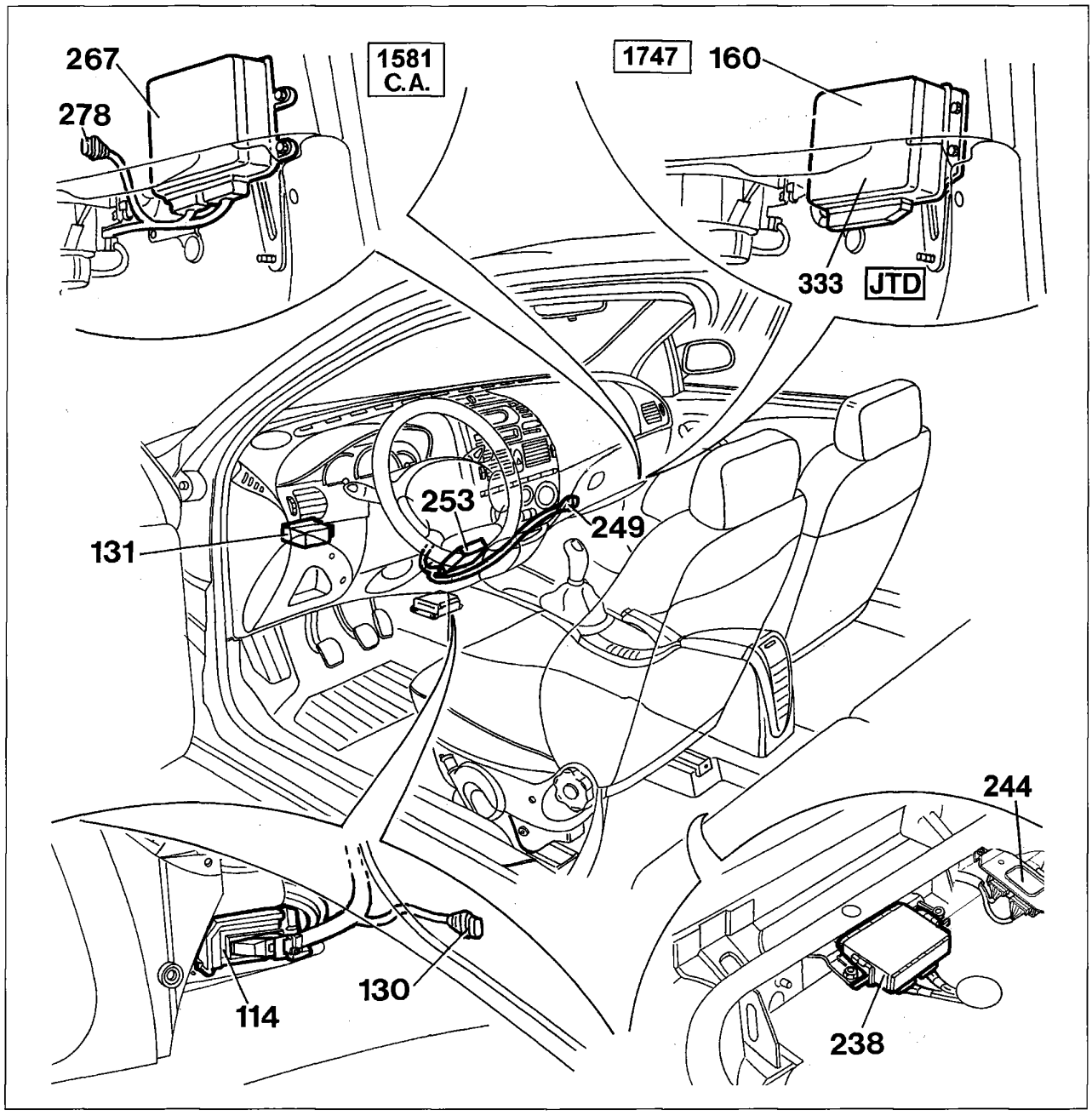
100 Alarm electronic control unit
103 Tester socket for injection alarm
139 Tester socket for injection system (JTD)
176 Diagnostic socket for anti-lock brakes (A.B.S.)
181 Electro-hydraulic control unit for anti-lock brakes (A.B.S.)
226 Diagnostic socket for Fiat CODE system (1910 TD-75)
302 Tester socket for EGR system (1910 TD-75)
333 Injection control unit (JTD)



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# 55.

## LOCATION OF CONTROL UNITS AND TESTING SOCKETS (PASSENGER COMPARTEMENT)




P4f012GL02

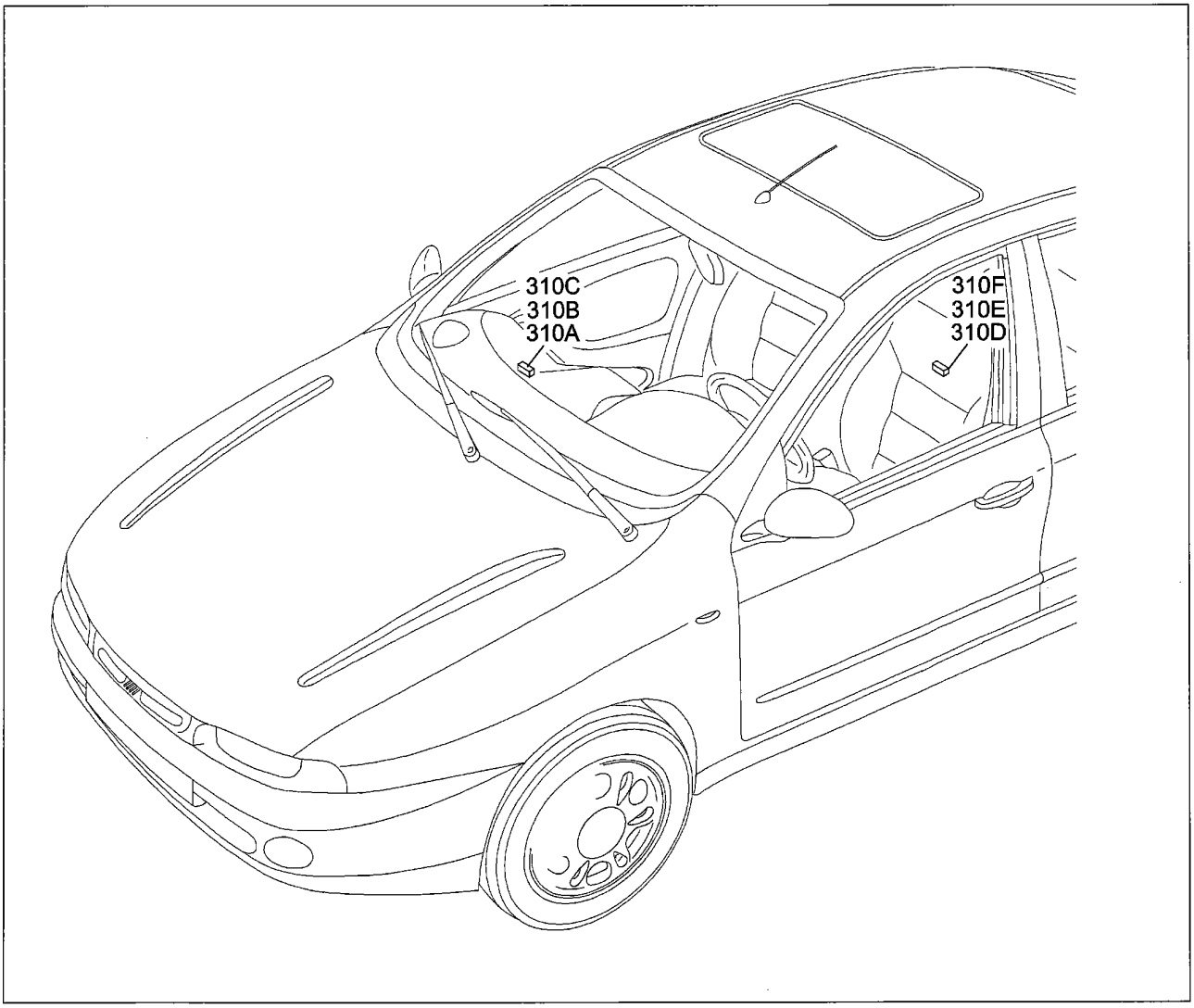
114 Air bag electronic contol unit
130 Tester socket for Air Bag
131 Fiat-CODE electronic control unit
160 Ignition/injection electronic control unit (1747)
238 Rear electric windows control unit
244 Integrated services control system
249 Diagnostic socket for climate control system
253 Air conditioner control unit
267 Automatic transmission control unit
278 Test socket for automatic transmission
298 E.G.R electronic control system (1910 TD-75)
333 Injection control unit (JTD)




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## LOCATION OF CONNECTION BRIDGES

A number of connection bridges are found on the car. These replace ultrasound welding and allow lines to be connected, according to the specifications or options installed.




4F013GL01

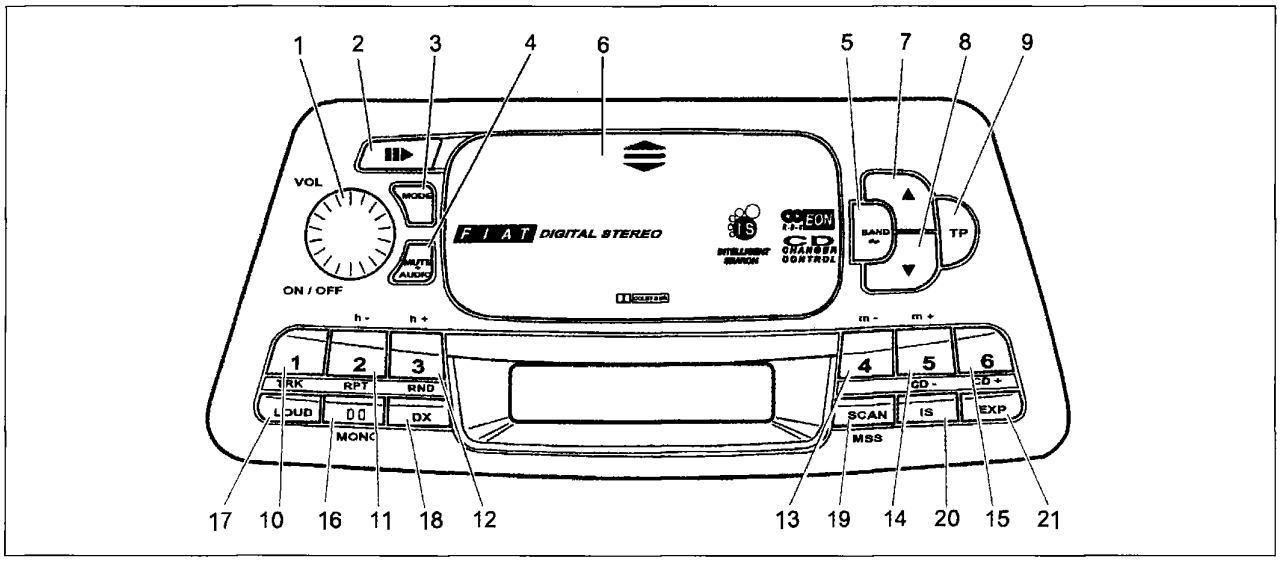
310A Connection bridges under the facia
310B Connection bridges under the facia
310C Connection bridges under the facia
310D Rear connection bridges
310E Rear connection bridges
310F Rear connection bridges



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# 55.

RADIO CASSETTE PLAYER MODEL AD 182 H2




4A36HL01

1. VOL BUTTON: switch radio on / off, volume control increase/decrease and Balance/Fader functions
2. Cassette eject button
3. MODE button: select Radio, Cassette Player and CD player functions; temporary cassette mute
4. AUDIO-MUTE: select Bass, Treble, Balance and Fader functions; MUTE function
5. BAND button: select FM1, FM2, FM3, MW and LW bands; tape autoreverse; select AUTOSTORE function
6. Cassette player entry slot compartment

7.8. Buttons to recall IS memory content; RDS station search; manual station search; set volume TP function ; PTY programme selection; change CD or Tape track; cassette or CD fast forward / rewind; select EXPERT control level settings

9. TP Buttons: select Traffic Program function and Programme Type function (PTY); select alternative frequencies function (AF)
10. Station storage button N1: select TRACK REPEAT function
11. Station storage button N2: CD player TRACK REPEAT function
12. Station storage button N3: select TRACK RANDOM function; set time; enter secret code number
13. Station storage button N4: select volume TP function; set minutes; deactivate watch synchronisation with RDS TIMER signals; select LNR function; set default volume; select mute function if VIVAVOCE system is present; adjust telephone input sensitivity; input secret code; deactivate BOOSTER delay
14. Station storage button N5: select volume TP function; select previous CD; synchronise watch with RDS TIMER; deactivate LNR function; set default volume; activate BOOSTER delay; deactivate mute function if VIVAVOCE system is present;select telephone input sensitivity; input secret code
15. Station storage button N6: select next CD
16. Activate DOLBY function
17. LOUDNESS function activate/deactivate button
18. Button for setting radio station search function sensitivity
19. SCAN/MSS button: activate/deactivate cassette MSS function; activate/deactivate CD SCAN function
20. IS Button: Tuning and automatic IS intelligent search
21. EXP button: activate EXPERT level control




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## GENERAL DESCRIPTION

A car radio system with the following components is available on request:
- radio-cassette player (non-removable) model AD 182 H2 that inserts into the previous radio slot in the center of the instrument facia. The customised front panel integrates fully with the facia line
- 6 speakers of which 2 are placed sideways on the upper part of the instrument facia, 2 are placed on the interior panels of the front door as per the previous system and finally 2 are placed in the rear parcel rack
- stylus type aerial on the front central section of the roof
- CD connection lead

Radio-Cassette player model AD 182 H2 is equipped with the following functions:

### Radio select

- PLL Tuning with frequency bands FM/MW/LW
- RDS(RADIO DATA SYSTEM) with TP (Traffic Program) functions - EON
- Automatic/manual station tuning
- Manual storage of 6 stations in bands FM1, FM2, FM3 and in bands MW and LW
- Automatic station storage using Autostore function on buttons 1,2,3,4,5,6 in bands FM1, FM2, FM3, MW and LW
- Automatic DX function (Distant: maximum radio station search sensitivity)
- Automatic storage (Autostore)

### Cassette select

- Autoreverse
- Tape fastforward and rewind
- Music Search System function (automatic search for previous/next track)
- DOLBY B (noise reduction circuit)(*)

### Compact Disc selection (if CD player fitted)

- Disc select(Disc no.)
- Track select
- Track scan (function SCAN)
- Fast wind and rewind (function TRACK FAST)
- TRACK REPEAT
- Track repeat (function REPEAT)
- Random track repeat (function TRACK RANDOM)

### Audio select

- Loudness function
- Mute function
- Pause function
- Individual controls for adjusting bass and treble
- Left/right and front/rear channel balance
- Radio on/off system select
- TP function volume level presetting

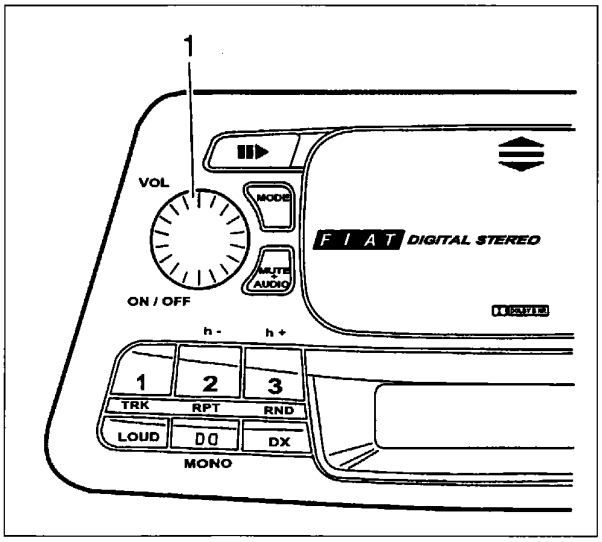
### Clock section

- Hour/min adjustment
- Expert control level section
- Anti-theft protection

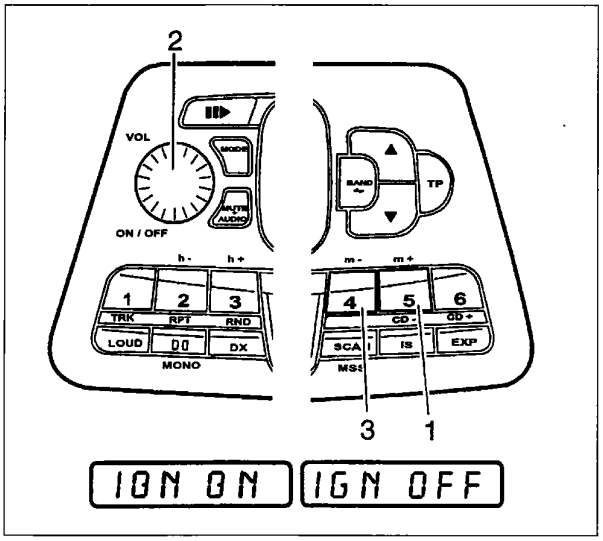
*(*) The DOLBY noise reduction circuit is manufactured under license from Dolby Laboratories Licensing Corporation. DOLBY and the double D symbol are their registered trademarks.*

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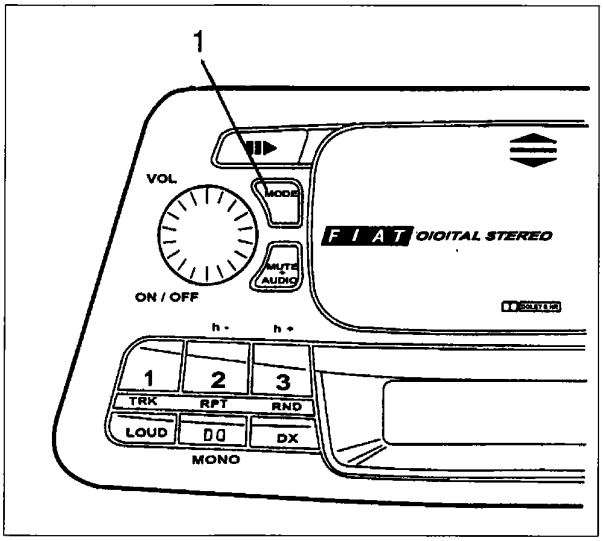

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4A38HL01




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### Operation

### Switching on car radio

Press the VOL (1) button once to switch on the car radio. If the car radio is switched on when the engine is not running it will automaticaly switch off after about 20 mins.

### Switching on/off when the engine is started/stopped

The car radio has a switch-on system that, if activated, switches on/off the car radio at the same time as the engine is started/stopped.
If the system is active the car radio will switch on/off when the engine is started/stopped;
If the system is not active: starting/stopping the engine does not switch on/off the radio.
To activate the system, switch off the car radio then hold down station selection button 5 (1) until "IGN ON" appears on the display, then switch on the car radio using the "VOL" button.
The system will only be activated when the car radio is switched on using the "VOL" button.
To deactivate the system, hold down station selection button 4 (3) with the car radio switched off, until the message "IGN OFF" is displayed.

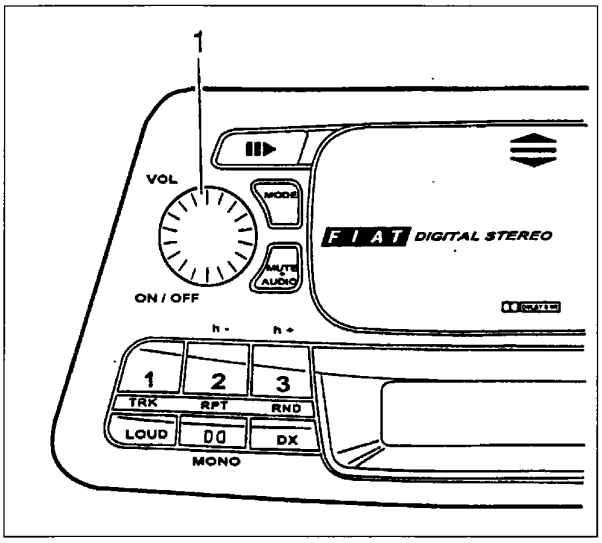
### Selecting radio / cassette / Compact Disc functions

Press the MODE (1) button repeatedly to cycle through the following functions:
RADIO, the display temporarily shows the message "RADIO"
CASSETTE (if previously activated), the display temporarily shows the message "TAPE A" or "TAPE B"
COMPACT DISC (if the CD player is fitted), the display shows the message "MCD"

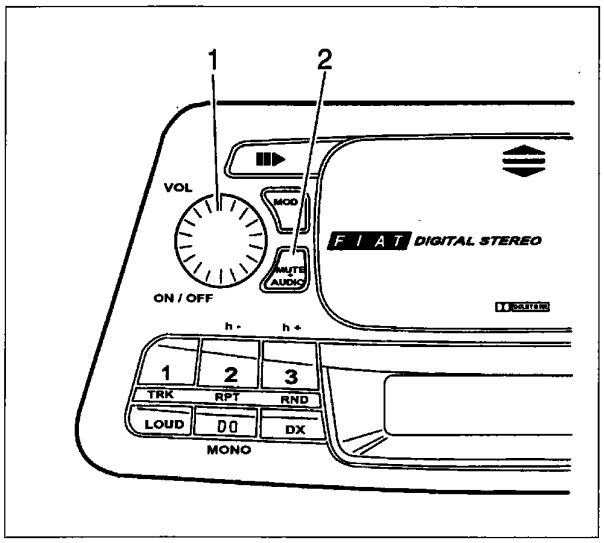
**NOTE** *The functions that cannot be selected are automatically excluded.*



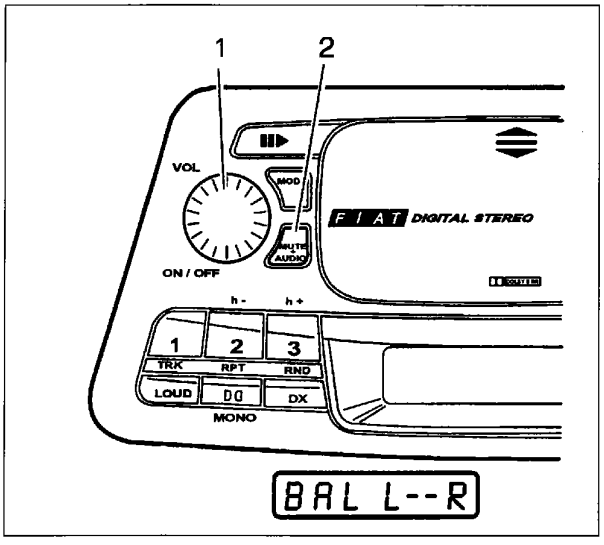

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### Pause function

When listening to a Cassette or a Compact Disc, if a different function is selected (the radio for example) then playback is interrupted. When you return to "Cassette" or "Compact Disc" mode, playback continues from the point where it was interrupted. If you select a different function while listening to the radio, returning to "Radio" mode will automatically tune you to the most recent station selected.

### VOLUME adjustment

The volume can be adjusted using the VOL (1) knob.
The volume level, between "VOL 00" and "VOL 31", appears on the display when the volume is being adjusted.

### BASS and TREBLE adjustment (BASS and TREB)

Select the "BASS" or "TREB" function by pressing the AUDIO (2) button 1 or more times.
Once the function has been selected, use the VOL (1) knob to achieve the required sound.
To restore the default setting, press the AUDIO (2) button for about 3 seconds until the message "00"or " " appears on the display.

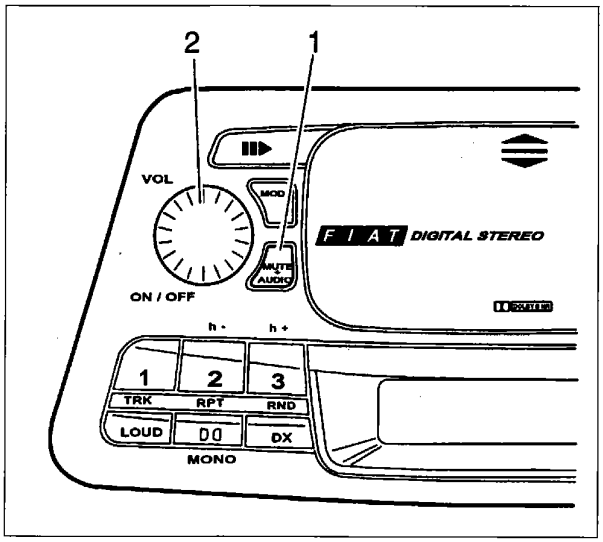
### Adjusting BALANCE between left and right speakers (BALANCE)

Balance refers to the "volume ratio" between the left and right speakers.
To adjust, press the AUDIO (2) button a few times until the "BALANCE" function is selected. The message "BAL L- -R" appears on the display. Use VOL (1) knob to adjust the balance as required.
The selectable values range from 0 to 15 To restore the default settings, press the AUDIO button for about 3 seconds until the message "00" or "--" appears on the display.

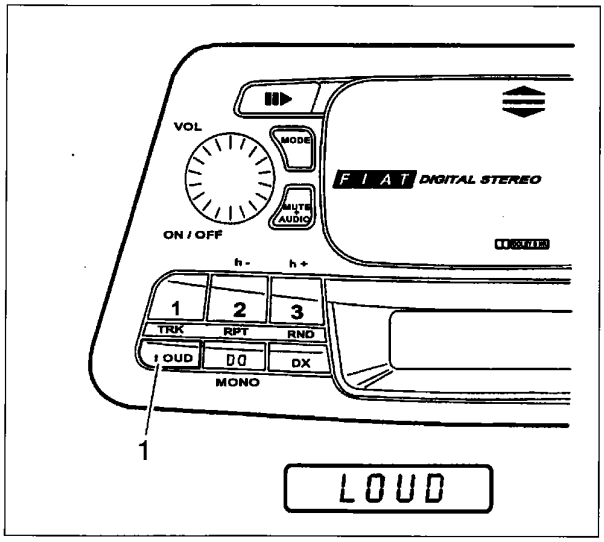


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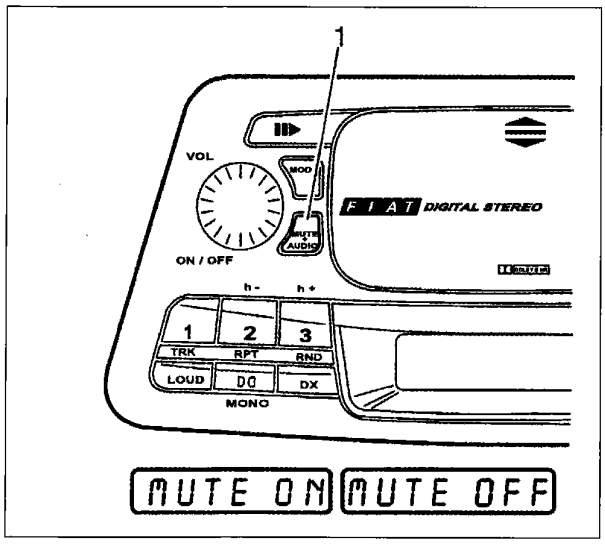
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### Adjusting the balance between front and rear speakers (FADER)

Select the FADER function to change the volume distribution between the front and rear speakers.
To select the FADER function press the AUDIO (1) button 1 or more times until the message "FAD 0" appears on the display. Use VOL (2) knob to change the sound level: greater emphasis can be placed on either the front or the rear speakers.

### LOUDNESS function

The LOUDNESS function improves the sound at lower volumes.
Pressing the LOUD (1) button activates this function and displays the message "LOUD".
Press the LOUD(1) button again to deactivate the function previously activated.

### MUTE Function

Press the Audio button (1) for about 3 seconds to select the MUTE function and to display the message "MUTE ON" (appears in lower half of dsiplay)
Press the AUDIO button again to deactivate this function. The message "MUTE OFF" appears on the display.
When the mute function is selected, the radio does not send a signal to the speakers.

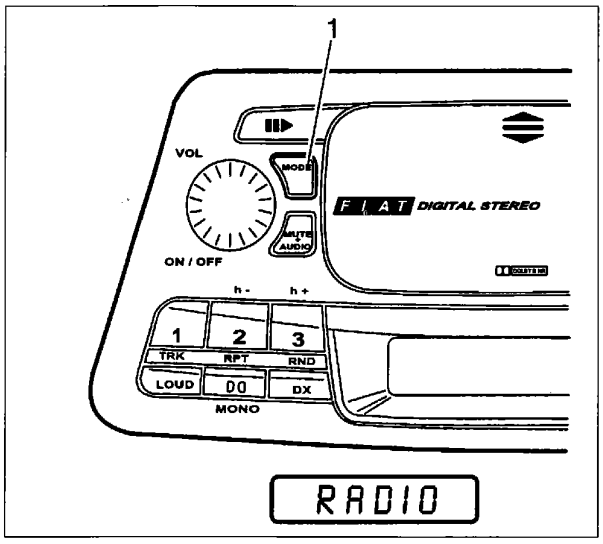
### Radio function

*Reception conditions vary constantly when driving. Reception can be affected by mountains, buildings or bridges particularly when the station transmitter is far away.*

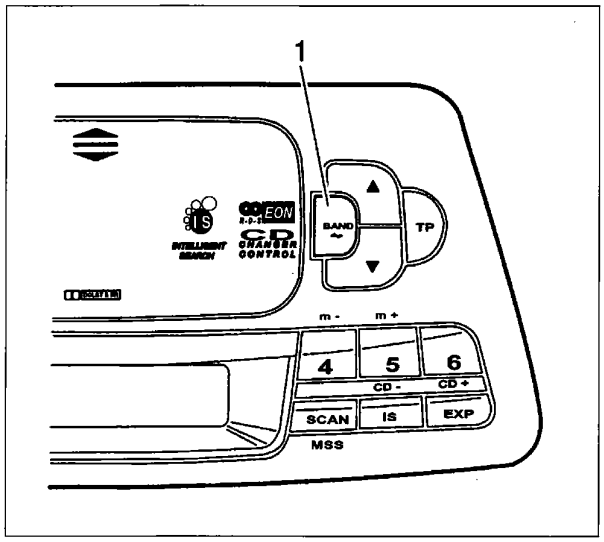
**NOTE** *When the RADIO function is activated, the radio will tune to the most recent station you were listening to before the radio was switched off.*



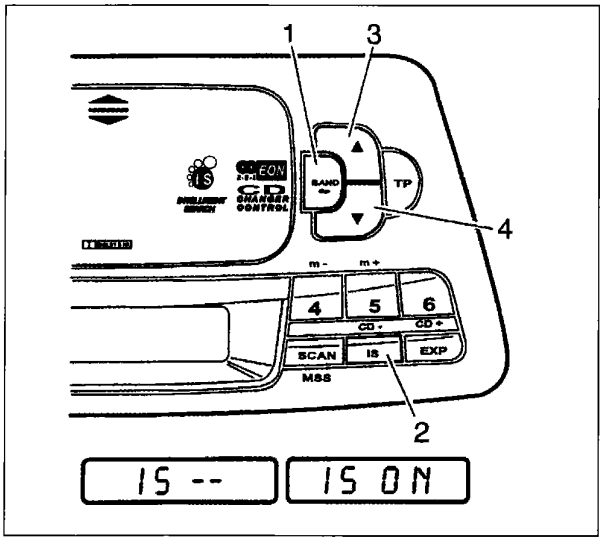

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## Function selection

As soon as the car radio is switched on, the radio comes on. To select the Radio function when listening to a cassette or a compact dsic, keep pressing the MODE (1) button until the message "RADIO" appears on the display.

## Band selection

Press the BAND (1) button a number of times to select the available frequency bands. The relevant frequency band appears on the display. The possible messages are:
- "FM1", "FM2", "FM3" for FM bands
- "MV", medium wave, "LW", long wave, for AM bands

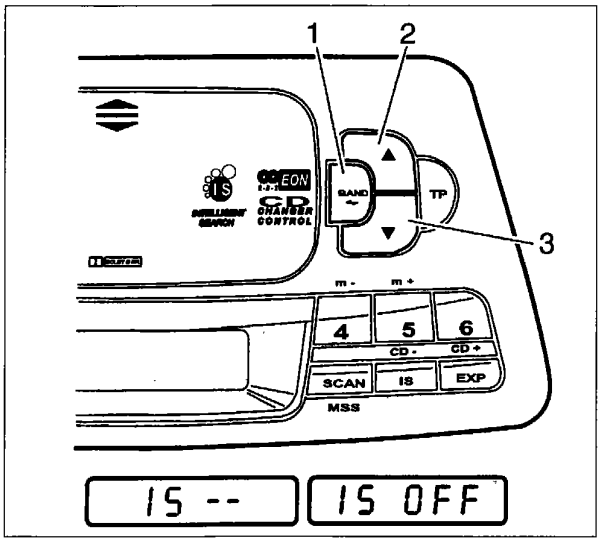
## Intelligent automatic tuning and search (IS function)

Use the BAND (1) button to select band "FM1", "FM2" or "FM3".
Press the intelligent automatic search function IS button (2).
When the search is ended, the RDS programmes are stored in radio IS memory first followed by the stations based on their transmission power. The IS memory can store up to 30 stations. The reception remains active even if no reception is possible; to stop it, press one of the station selection buttons (1,2,3,4,5,6).
To recall the stations stored in the IS memory select the IS mode by pressing either the "▲" or "▼" button (3,4) for about 3 seconds until the message "IS- -" is displayed followed by "IS ON". Press button "▲" or "▼" to recall the stored stations one by one.

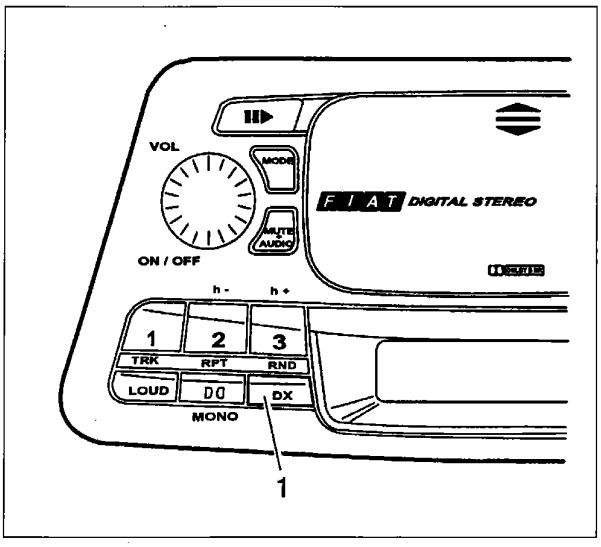


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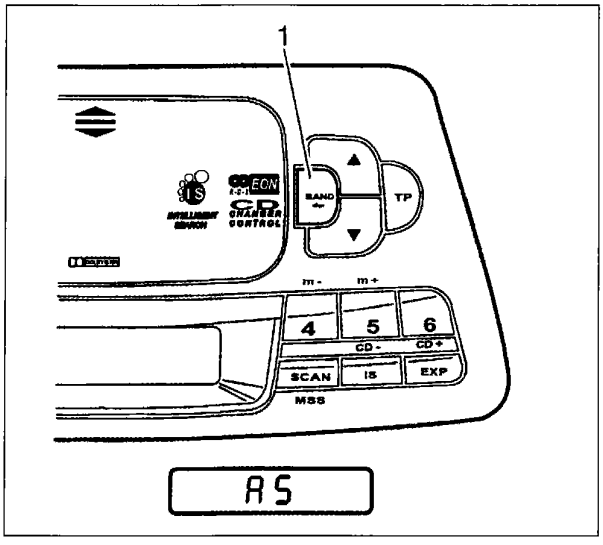
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**RDS** stations automatic search and **tuning**

Select the required FM or AM frequency band using the BAND button (1).
The IS function should not be active for this selection. If the IS function is active press either the "▲" or "▼" button (2,3) until the message "IS--" appears on the display followed by "IS OFF".
Press button "▲" or "▼" (2,3) to start the automatic search.
When a station with an identifying code is found the code appears on the display.

**DX** function

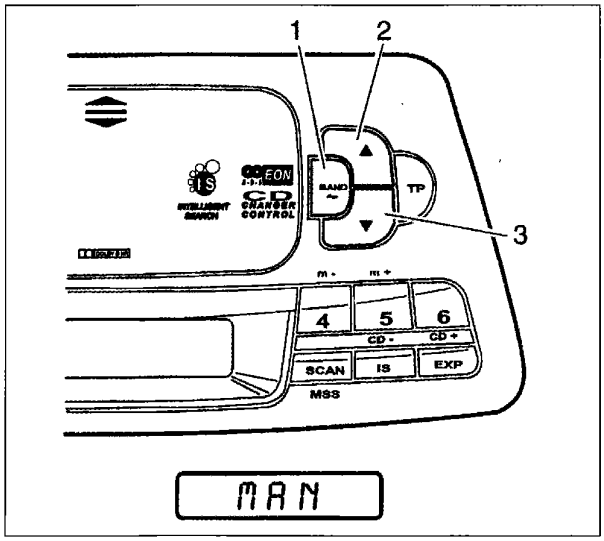
The DX function allows you to select the sensitivity of the radio station search. When the DX function is active, the radio only selects stations with a power greater than a fixed reference value. When the DX function is inactive even the radio stations with a lower power are selected. To activate the DX function, press key (1); pressing the same key again deactivates the function.

**Automatic storing of stations (AUTOSTORE Function)**

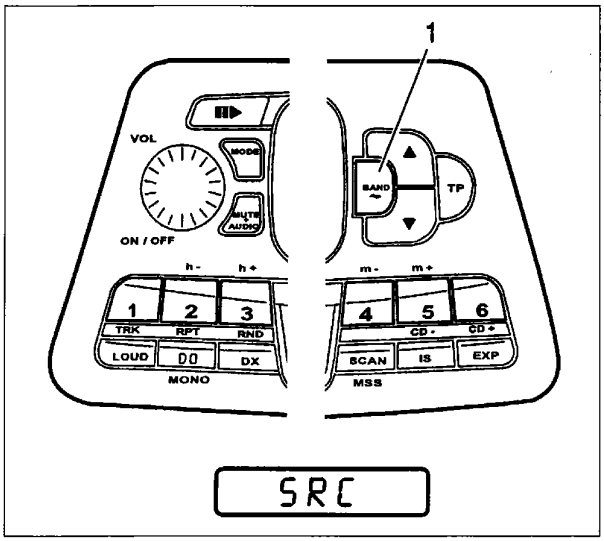
Use the BAND (1) key to select the requested frequency band. The display shows the selected frequency band.
Press the BAND button for about 6 seconds. The message "AS" appears on the screen first followed by the scan of the frequencies.
Once the frequency band scan is complete the 6 most powerful stations are available through the frequency selection keys (1,2,3,4,5,6).



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### Manual station storage

Use BAND (1) button to select the frequency band. The selected band appears on the display as "FM1", "FM2", "FM3", "MW", or "LW"
Press button "▲" or "▼" (2,3) for about 6 seconds until the message "MAN" and the current radio frequency appear on the display.
Use buttons "▲" and "▼" to change the tuning frequency.
The current station can be stored in the frequency band selected using the frequency selection keys (1,2,3,4,5,6). To store, press the preset frequency selection key until sound can be heard again.
Manual tuning can be ended at any time by pressing one of the frequency selection keys or by not pressing any key for 60 seconds.

### Listening to stored stations

Proceed as follows:
1. Use BAND button (1) to select the required band.
2. Press one of the frequency selection keys (1,2,3,4,5,6).

The display shows the key pressed as well as the station code if it is an RDS station.
If the selected station offers an RDS service and the reception is poor, the radio will search for an alternative frequency for the station. The message "SRC" appears on the display during the search.

### TP Function (TRAFFIC PROGRAM)

Some stations in bands RDS1 and RDS2 also transmit traffic reports. The TP (Traffic Program) function allows you to:

- search only for RDS stations that transmit traffic information;

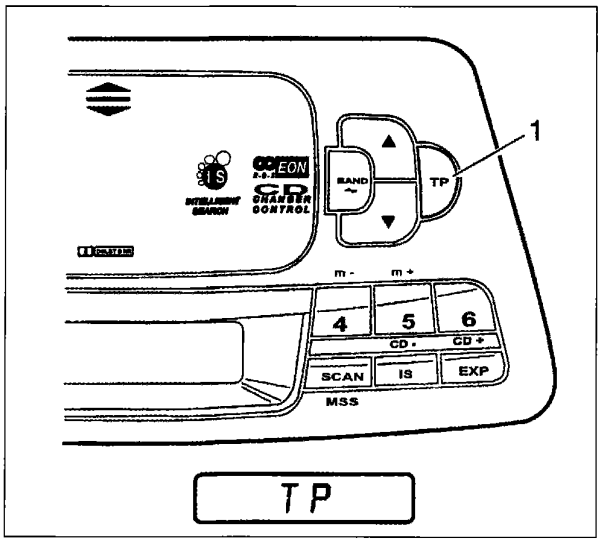
- receive traffic information even when the cassette or Compact Disc player function is active;

- receive traffic information at a minimum pre-set level even if the radio voulme is set to zero.

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NOTE *The following are instructions for carrying out all the operations shown in points a), b) and c) previously indicated.*

Point a)

To select a station with traffic reports service press TP button (1) The message "TP" appears on the display.
If the first station does not provide traffic reports, the radio automatically tunes to the closest station that does provide them.

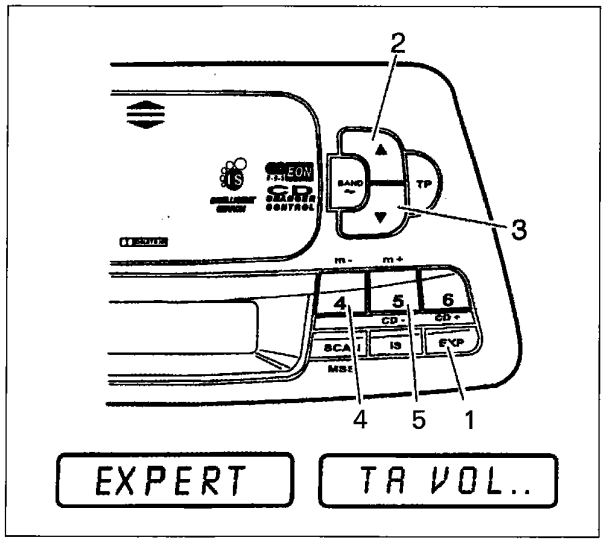
Further stations with traffic reports can be stored using the station selection buttons. To do this, follow the instructions in the paragraph "Station tuning and storing" but first ensure you press the TP button to activate the TP function.
As an alternative to manual storing, you can also follow the instructions in the paragraph "Automatic station storage (AUTOSTORE)" but first ensure you press the TP button to activate the TP function.

Point b)

If you want to receive traffic reports tune to a RDS TP station before inserting a tape or Compact Disc. If a traffic report is transmitted while you are listening to a tape or Compact Disc then playback will be temporarily stopped and will start again when the report is finished.

Point c)

Traffic information can still be received if you are not listening to the radio. Having tuned to a RDS TP station and having set the volume to zero, if traffic information is transmitted from the same station, this will be heard at the preset volume.




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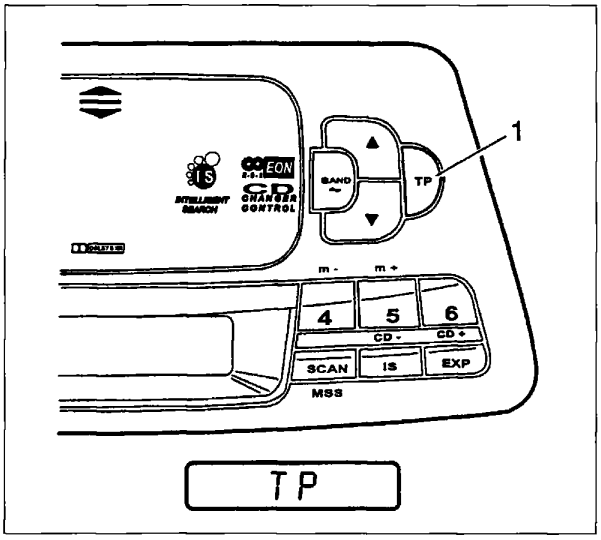
*In some countries there are radio stations that do not transmit traffic reports even with the TP function active.*

**Setting the TP (Traffic Program) function volume**

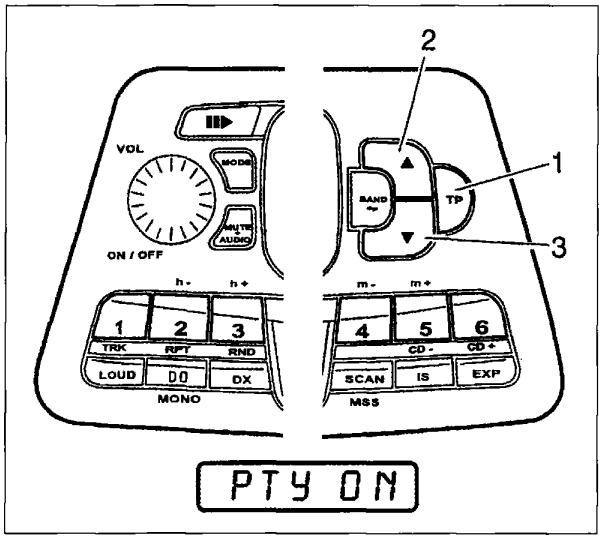
To select the traffic report volume press the EXP button (1) until the message "EXPERT" is displayed. Then press key "▲"(2) or "▼" (3) until the message "TA VOL" is displayed. Use keys 4 (4) and 5 (5) to select the required volume. The volume can vary between 5 and 31.




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## EON (ENHANCED OTHER NETWORK) Function

In some countries a circuit is active that groups together stations that transmit traffic reports.
In these cases, the RDS TP station broadcast will be interrupted to receive traffic reports if these are transmitted by a station in the same circuit.
To exclude the EON function, press the TP (1) button; the LED under the button will switch off.

## PTY function

Some radio stations offer the "Programme type" (PTY) function in the FM band. The PTY function can be used to automaticaly select a station that offers a particular type of programme eg classical music.

## Automatic PTY search

The search can be carried out by assigning 6 types of program selected by you, to the station selection keys (1,2,3,4,5,6) or by selecting the type of programme from the stored list and then starting the search.
Refer to the paragraphs below for further details.

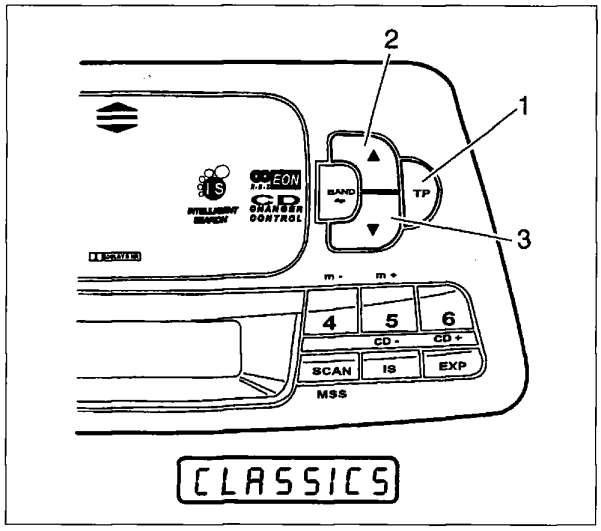
## Storing the types of programme required on the station selection buttons

Press button TP (1 on above figure) for about 6 seconds until the message "PTY ON" is displayed Select the type of programme required using keys "▲" (2), "▼" (3).
Once you have found the programme type you want eg classical music "CLASSICS", press the station selection button (1,2,3,4,5,6) required, for more than two seconds. The selected programe type will then be assigned to the button that you press.
Every station can be assigned a programme type by repeating the above procedure.
To start the automatic search for a station that transmits a particular type of programme, press the TP (1) button again for about 6 seconds.
The message "PTY ON" appears on the display. Then press the station selection button for the type of programme required. The selected programme type is displayed. The automatic search can be started by pressing buttons "▲" (2), "▼" (3) for about 2 seconds. The search stops when a station that transmits the type of programme requested is found.

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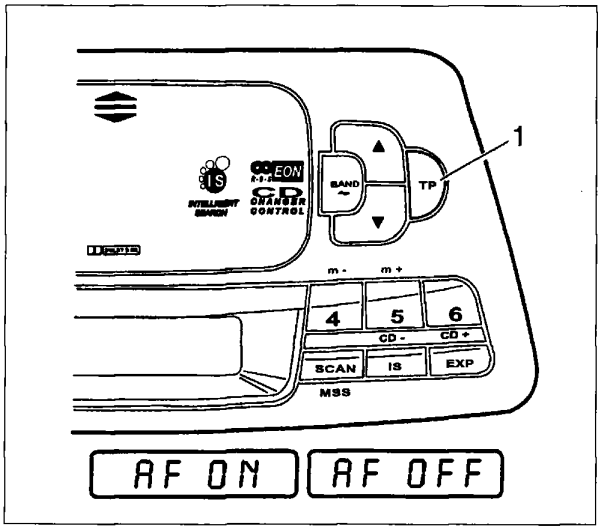



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### List of available programme types

The types of programme offered by a radio station vary according to the type of programme transmitted.

NEWS: News programmes and current affairs
AFFAIRS: Politics and events
INFO: Special information programmes
SPORT: Sports transmissions
EDUCATE: Training and study
DRAMA: Radio plays and literature
CULTURE: Culture and religion
SCIENCE: Science programmes
VARIED: Programmes with varied content
POP: Pop Music (hits)
ROCK M: Rock Music
EASY M: Easy listening
LIGHT M: Classical easy listening
Classics: Classical Music
OTHER M: Music programmes that cannot be classified eg folklore




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### Tuning to the type of programme using the list

Activate the TPY function by pressing the TP button (1) for about six seconds until the message "PTY ON" is displayed.
Keep pressing buttons "▲","▼" (2,3) to progressively display the programme types available from the list Identify the type of programme required then press key " " or " " for about 2 seconds to start the automatic search The search stops when the radio tunes to the selected programme type. The programme type eg "CLASSICS" is displayed.

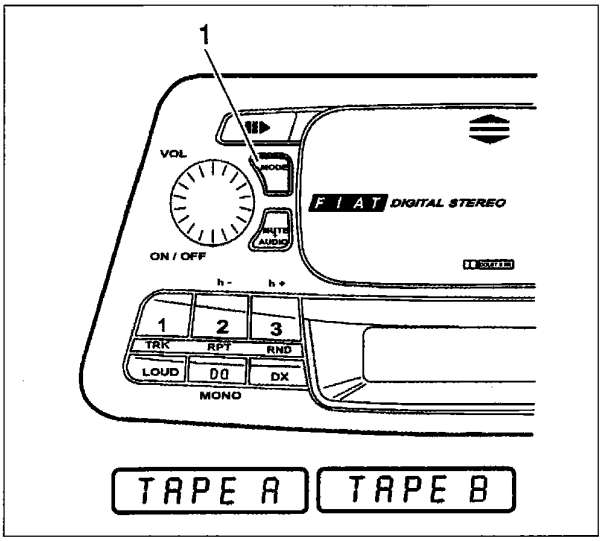
WEATHER: Weather forecasts
FINANCE: Financial News
CHILDREN: Transmissions for children
SOCIAL: Social information
RELIGION: Philosophical / religious broadcasts
PHONE IN: Phone in programmes
TRAVEL: Tourist travel information
LEISURE: Free time, hobbies and pastimes
JAZZ: Jazz Music
COUNTRY: Country Music
NATIONAL: National transmissions
OLDIES: Golden Oldies
FOLK M: Folk Music
DOCU: Special reports
NO PTY: No identification code for type of programme

### Alternative frequency (AF)

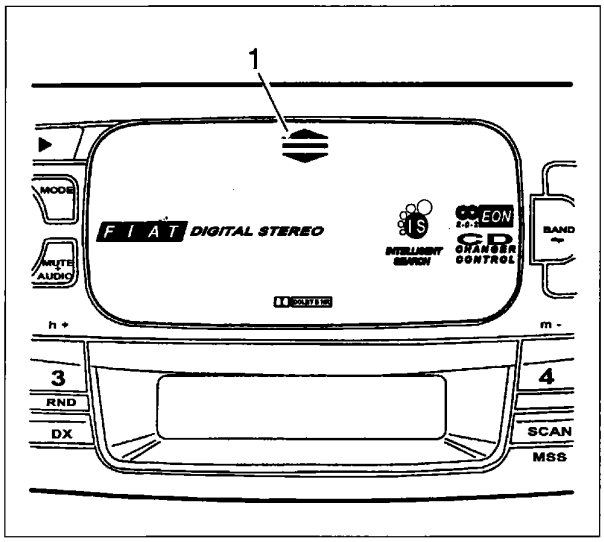
If an RDS programme comes is transmitted by more than one station, using different frequencies, then the radio automatically selects the clearest frequency.
To activate the AF function press the TP button (1) until the message "AF ON" is displayed.
To deactivate the AF function press the TP button (1) until the message "AF OFF" is displayed.



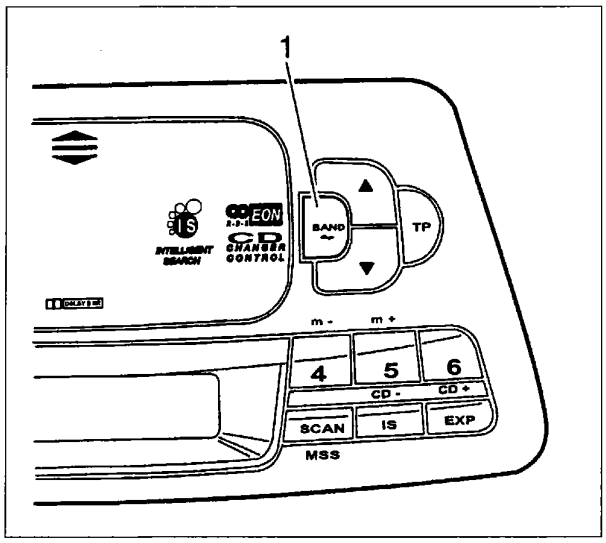

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## CASSETTE PLAYER

### Activating the cassette player

The car radio comes equipped with a cassette player which is turned on by inserting a cassette directly into the cassette compartment or, if the cassette is already inserted, by pressing the MODE key (1) repeatedly until the message "TAPE A" or "TAPE B" is displayed.
The player allows you to listen to both side of the cassette without removing the cassette (AUTOREVERSE function).

### Inserting the cassette

Open the cassette compartment flap.
Insert the cassette as far as it will go, keeping your hand on it until the car radio draws it in automatically and starts the playback.
To close the cassette compartment, press the key (1) until you hear the flap retaining clip click into place.

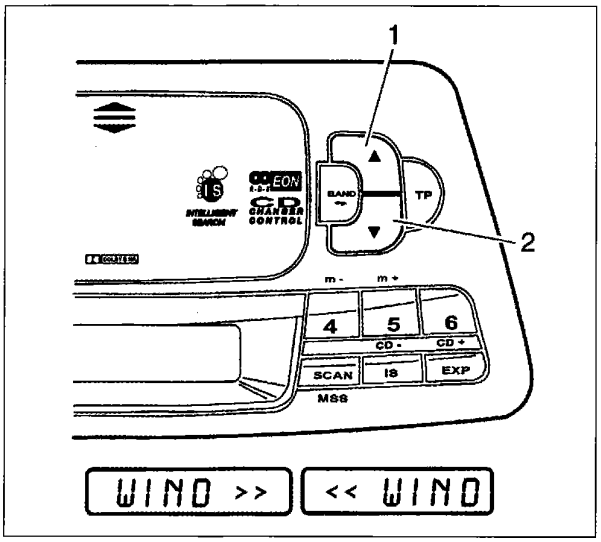
### Changing cassette side

With a cassette inserted into its compartment and the message "TAPE A" or "TAPE B" being displayed, press the BAND key (1) When the end of the tape is reached the side changes automatically. The messages "TAPE A" and "TAPE B" refer to the upper and lower sides of the tape.

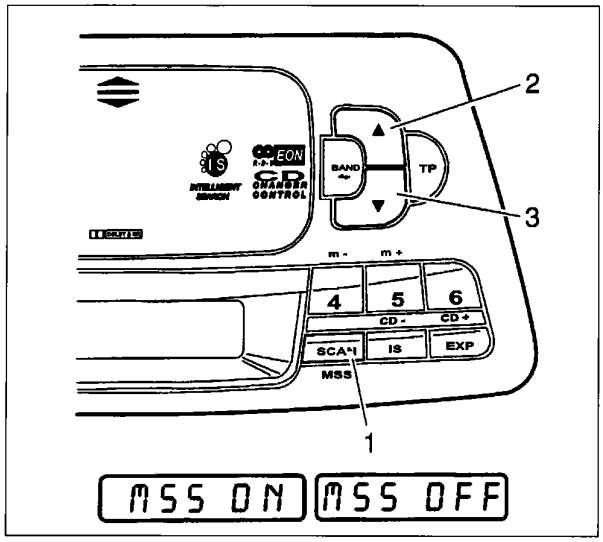


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4A48HL02

Fast forward / rewind

During playback press key "▲" or "▼" (2) respectively to fast forward or rewind the tape. The message "WIND"" or ""WIND" is displayed during this operation.
To stop this function briefly press key "▲" or "▼" (2). Once the function is stopped, the cassette player automatically restarts the playback of the cassette.
When the tape is fully rewound or wound the player automatically starts the playback of, respectively, the same side or the reverse side of the cassette.

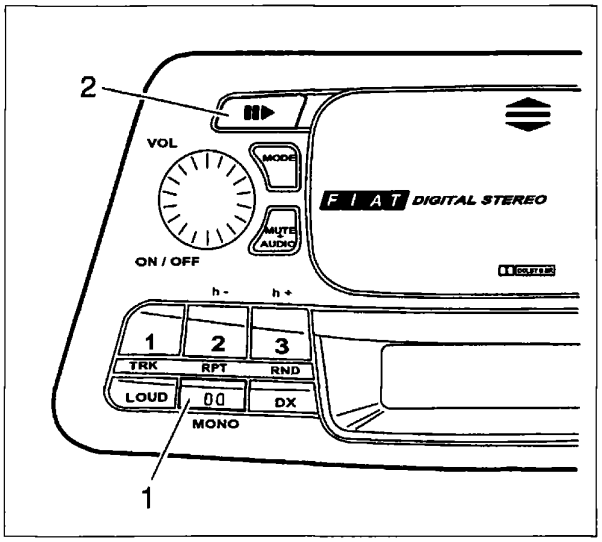
**Search for previous / next track (MUSIC SEARCH SYSTEM function)**

Allows you to skip or repeat one or more tracks that have a gap of less than three seconds between them.
To activate this function, press the MSS key (1) when the cassette is playing. The message "MSS ON" is displayed".
To skip to the next track, press key "▲" (2) while to go back to the previous track press key "▼" (3).
Press key "▲" or "▼" to exclude a number of tracks from the playback equal to the number of times the button is pressed.
To deactivate the MSS function prress key "MSS" (1) during cassette playback. The message "MSS OFF" is displayed.

*The previous/next track search function may not work properly with the following types of tape:*
- tapes recorded at very low levels (e.g. weak sound, imperfect recording);
- tapes with conversations;
- tapes with blank sections lasting longer than 3 seconds;
- tapes with long periods of silence in the recording;
- tapes with no blank sections (e.g live recordings);
- tapes with a lot of background noise in the blank sections.




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### DOLBY B Function

Press key (1) to activate the DOLBY function (noise reduction device produced under license from "Dolby Laboratories Licensing Corporation")(*).

When the Dolby function is active the relevant symbol is displayed.

*(*) Dolby and the opposing double D symbol are trade marks of the above company.*

### Ejecting the cassette

To eject the cassette from the cassette compartment slide button (2) to the right until the tape ejects.
- When the tape has been ejected, the message "TAPE" appears on the screen and the radio switches on, tuned to the most recent station listened to.

*The cassette cannot be ejected if the radio is switched off.*

### Pausing cassette playback temporarily

Cassette playback can be suspended using the MODE key; press the key again to restore playback.

*Do not expose the cassettes to heat or direct sunlight and keep them in their own boxes after use.*
*We would advise you to use high quality tapes no longer than C-90 to ensure optimum playback. Dirt on the cassette player heads from the tapes will eventually cause a reduction in the higher tones during playback so clean the playback heads every now and then with an appropriate non-abrasive cassette head cleaner.*

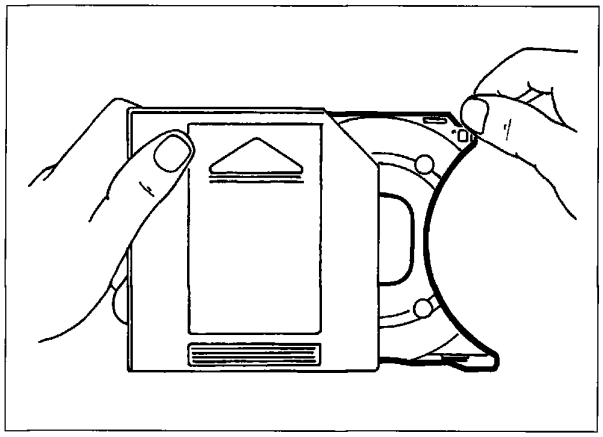
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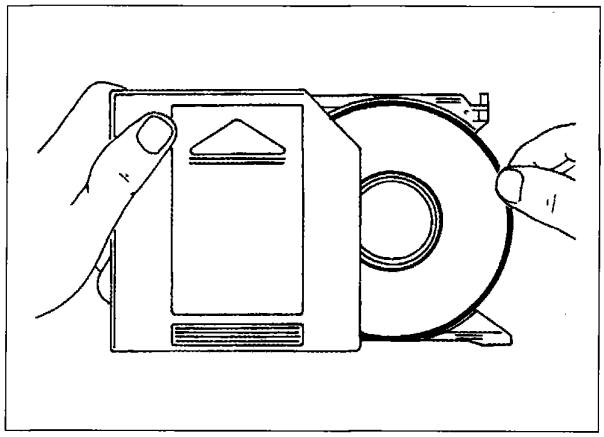
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### COMPACT DISC PLAYER FUNCTION

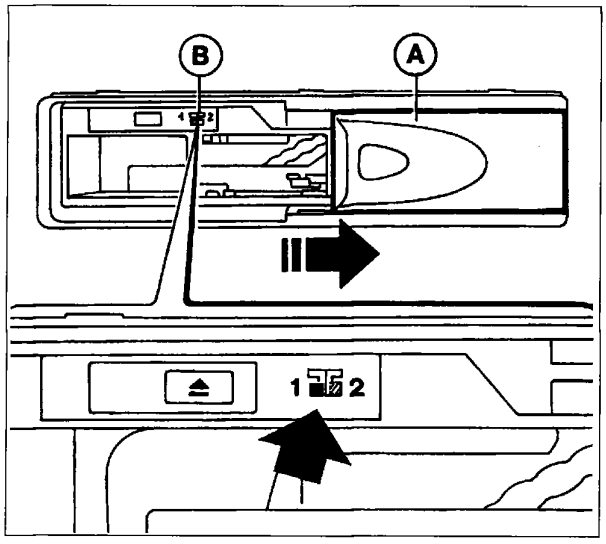
Cars fitted with radio AD 182 H2 have the wiring for a Compact Disc(CD) player to be installed, consisting of a multi pole lead that ends on the left side of the luggage compartment. A kit is available from FIAT Accessories consisting of a Compact Disc player, an extra multi pole connection lead and mount for fitting the lead.
The reader comes with a magazine with a capacity for up to 6 CDs.



4A50HL01



4A50HL02




4A50HL03

**Filling the CD magazine**

- Remove one mount for every CD you want to play.

- Insert the CD with the label or the printed side facing the mount.

*Do not play the CD if it has been positioned incorrectly.*

**Inserting the magazine into the CD player**

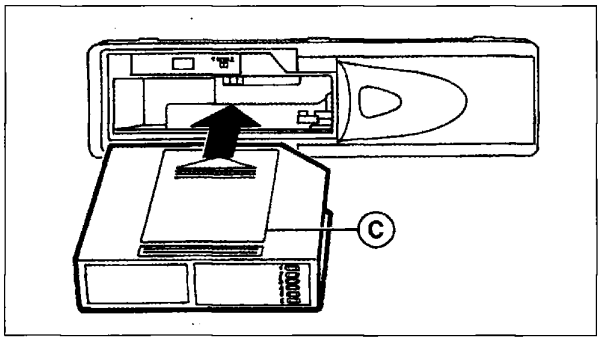
**NOTE** *The CD player is not designed for playing 8 cm CDs, which require adaptors available from Hi-Fi stores.*

To insert the magazine into the CD player proceed as follows:

- slide flap A to the right as shown in the figure until it is no longer locked;
- check that switch B is in position "1".

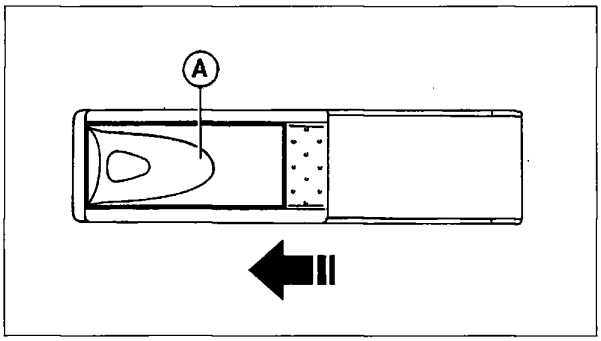



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4A51HL01

- insert magazine C into the CD player with the labelled side (see arrow) facing up.

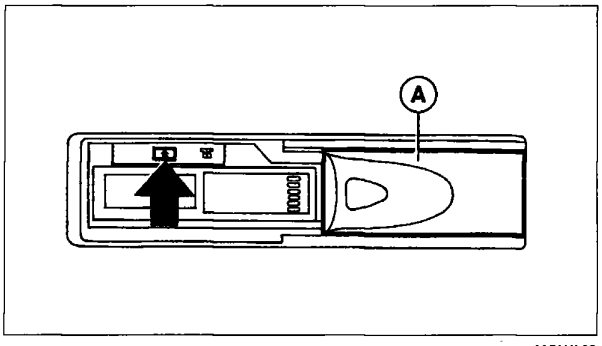



4A51HL02

- close sliding flap A after inserting the magazine in order to prevent foreign bodies or dust entering the CD player.

**Remove the magazine from the CD player**

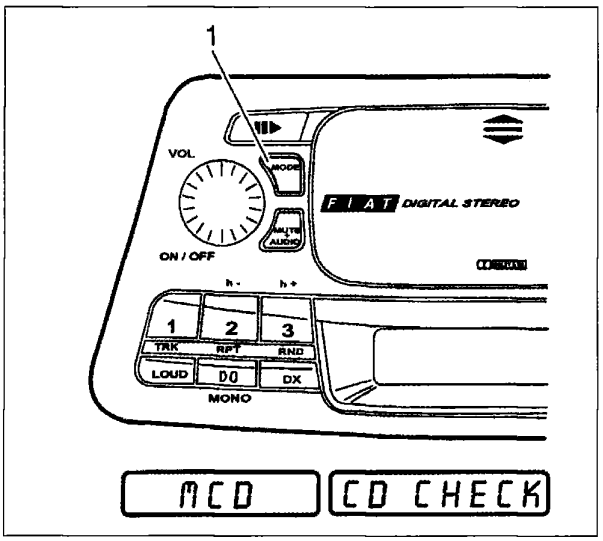
Proceed as follows:
- slide flap A towards the right as shown in the figure until it is no longer locked;
- press the eject button on the CD player, indicated by the arrow.




4A51HL03

**Removing the CDs from the magazine**

Remove the CDs and the mounts one by one from the magazine.




4A51HL04

CD playback

To play the CDs already inserted in the CD player keep pressing the "MODE" button (1) until the message "MCD" appears on the display.
If this function is selected every time the magazine is inserted the message "CD CHECK" is displayed while the system examines the connections and contents of the magazine.
During playback the message "CD" appears on the screen as well as the track number (e.g "T03" = third track), the play time "03:14" =3 minutes and 14 seconds) and the CD number (e.g. "4").



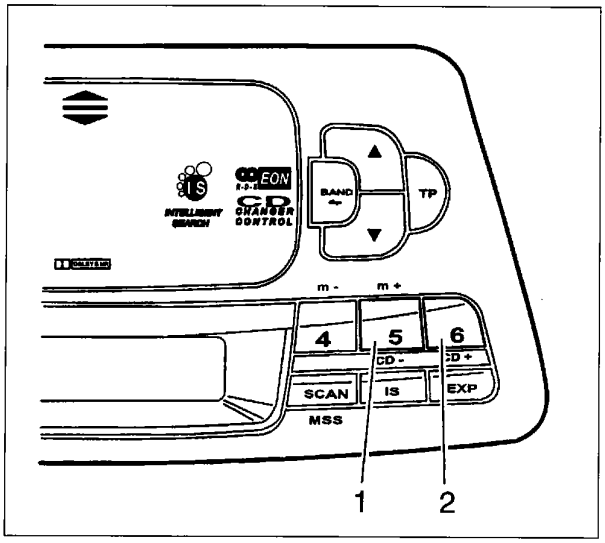
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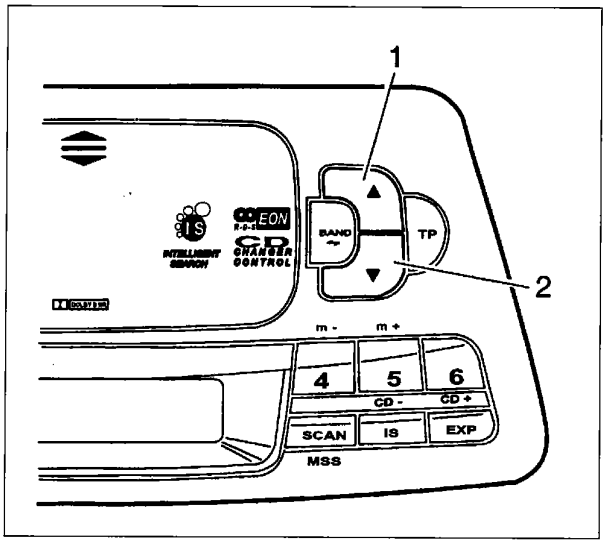
Possible error messages:

If the magazine has not been inserted correctly into the CD player the message "MAGAZINE" appears on the display.
If the magazine does not contain any CDs, the mesage "NO CD" appears on the display.
If CD is damaged or is inserted incorrectly into the magazine, the mesage "SURFACE" appears on the display.
If the connection with the CD player is broken, the message "NO COMMU" appears on the display.
If the CD player has a mechanical fault, the message "MECHANIC" appears on the display.
If the CD player is overheating the message "TOO HOT" appears on the display.

*If the situation described above occurs, turn off the CD player for a while.*




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### CD selection

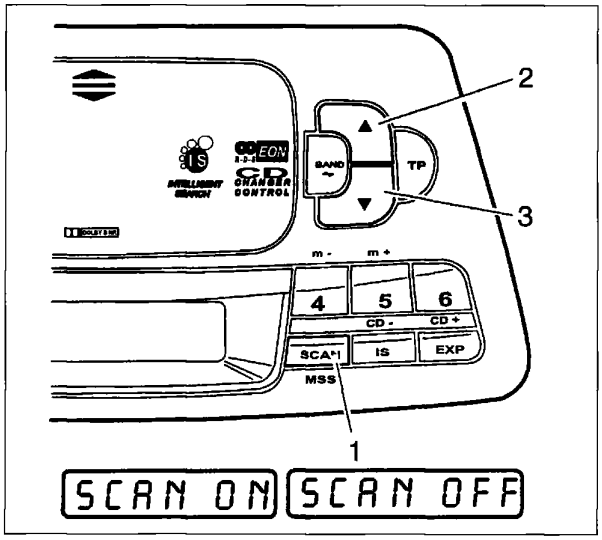
Keep pressing station selection key 5 (1) or 6 (2) until the required CD number is displayed.
Use station selection key 6 to skip to the next CD and key 5 to skip to the previous one.

### Track search (forward / back)

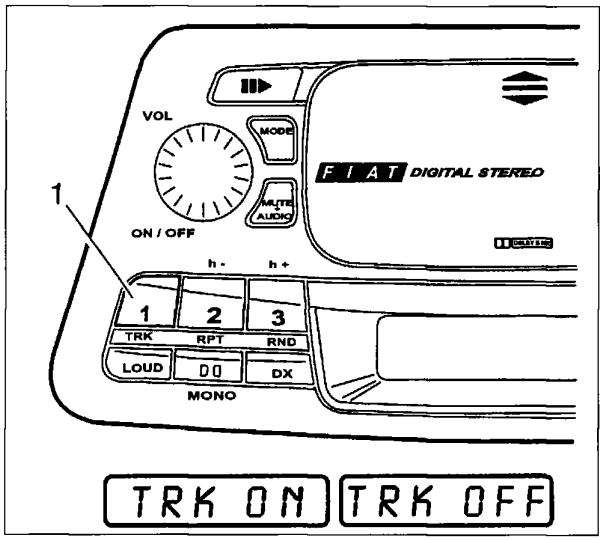
Keep pressing key "▲" (1) or "▼" (2) until the required track number is displayed.
Use key "▲" to select the next track and key "▼" to repeat the current track or to select previous tracks if pressed more than once.



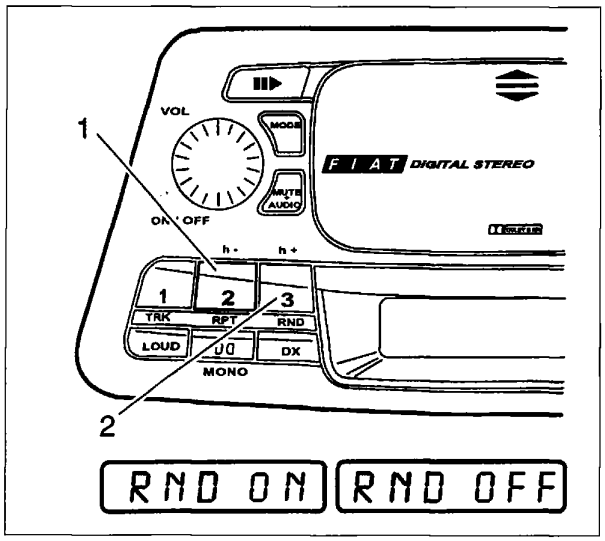

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4A53HL03

### Scanning the tracks on the selected CD (SCAN function)

Press SCAN button (1) to display the mesage "SCAN ON" and to make the CD player play all the tracks on the selected CD for 10 seconds each.
Press SCAN key (1) to disable the SCAN function once switched on. The message "SCAN OFF" is displayed.

### Fast forward and rewind (TRACK FAST function)

To hear the track at a low volume during fast forward or rewind hold down button "▲" (2) for fast forward and button "▼" (3) for rewind.

### Repeating current track (TRACK REPEAT function)

To repeat the current track continuously press station selection button 1 (1). The message "TRK ON" is displayed.
Press station selection button 1 (1) again to disable the TRACK REPEAT function previously selected.
The message "TRK OFF" is displayed.

### Repeating tracks from the selected CD (REPEAT FUNCTION)

To continuously repeat the current CD press station selection key 2 (1) The message "RPT CD" is displayed.
To stop repeating the current CD press station selection key 2 (1) again. The message "RPT MAG" is displayed.
The CD stops playing when the CD player has played the last track on the CD.

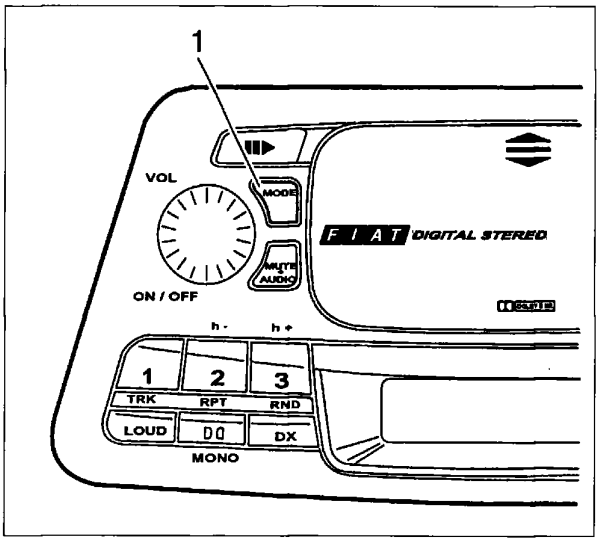
### Repeating tracks in random order (TRACK RANDOM function)

To start the random track search press station selection key 3 (2). The message "RND ON" is displayed".
To stop the random track search press station selection key 3 (2). The display shows the message "RND OFF".

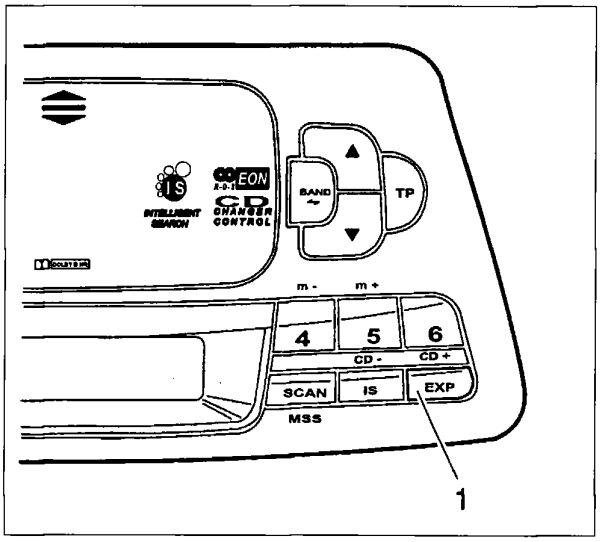


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Once all tracks have been played another CD is selected and so on. Once all CDs have been played, random playback restarts in the same mode.

NOTE *If "CD repeat" mode has been previously selected, only the tracks of the selected CD are played randomly.*

### Turning off the CD function

Press the MODE (1) button to stop CD playback and return to RADIO mode.

### Displaying CD player status

Press EXP button (1) to display any active special function *e.g.* "TRK ON".

*Never expose the CDs to heat sources or to direxT sunlight and place them back in their cases after use.*
*The CDs must be kept free from dust. Do not touch the surface of the CD and ensure it is not scratched to prevent interruptions in playback. If the surface of a CD is dirty, clean it with a wet cloth starting from the center and moving towards the edges. Do not insert damaged or distorted discs into the magazine.*



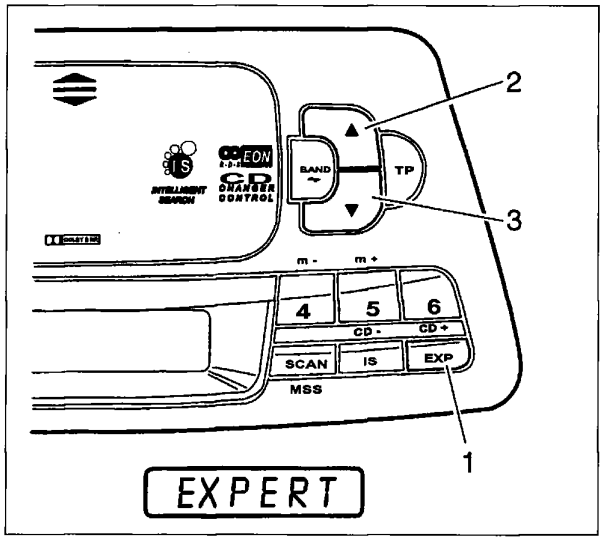

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## EXPERT CONTROL LEVEL

Use the supplementary EXPERT level to make adjustments that only need to be made once (e.g. setting the time) or only occasionally (e.g. setting the minimum volume for listening to traffic reports).

### List of possible EXPERT adjustments:

The following adjustments can be carried out in EXPERT mode:
1. Set time
2. Activate / Deactivate clock RDS synchronisation
3. Minimum volume for traffic reports
4. Activate / Deactivate LRN
5. Activate / Deactivate regional programme automatic change.
6. Switch-on volume limit
7. BDLY activate/deactivate delay for connected Booster
8. Switch on/off via vehicle ignition switch
9. Switch off sound when carphone in use.
10. Sensitivity of telephone input
11. SCV
12. Code adjustment



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### Selecting and altering the adjustments using EXPERT level control

Press key EXP (1) until the display shows the message "EXPERT".
Select the adjustment you want to make using key "▲" or "▼" (2,3).
Use the relevant frequency keys to set the required level.
Choosing the relevant frequency selection key depends on the adjustment you want to make. To identify them, refer to the following paragraphs relating to the possible adjustments.
To stop the adjustment, press again key "▲" (2) or key "▼" (3) or the EXP key (1) for about 3 seconds.

### Setting the TIME

The frequency selection keys required for setting the time are:
Keys 2 and 3 for setting the hour
Keys 4 and 5 for setting the minutes
To start the clock precisely to the second press key EXP

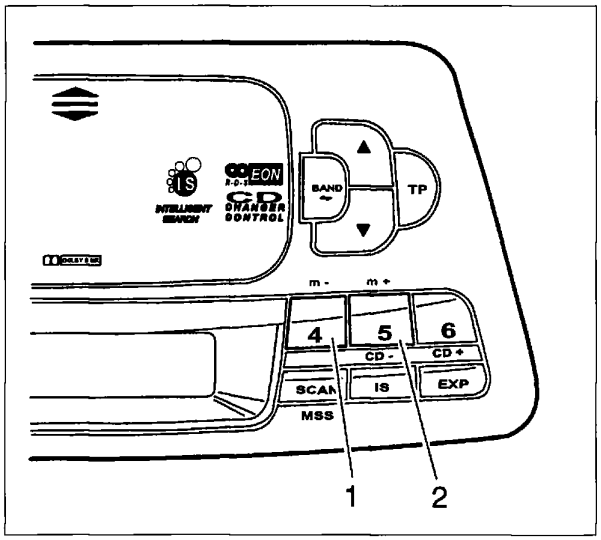
### Synchronising the watch

Allows the watch to be synchronised with RDS TIMER station signals:
The frequency selection buttons used are:
key 5 to activate the synchronisation
key 4 to deactivate the synchronisation
Press frequency selection key 5 to display the message "SYNC ON"; press frequency selection key 4 subsequently to display the message "SYNC OFF".



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### Minimum traffic information volume

To set the required volume, use frequency selection keys (4) (1) and 5 (2) to respectively increase or decrease the volume.
During the adjustment the display shows the message "TAVOL YY" where YY stands for the volume level that has been set.

### Activation / Deactivation LNR

Activates / deactivates the search for RDS stations with traffic reports.
The frequency selection keys for activation / deactivation are keys 4 (1) and 5 (2) respectively.
The display shows the messages "LRN ON" and "LRN OFF" respectively when the function is activated or deactivated (see figure).

### Automatic programme change (REGIONAL)

When the same RDS programme is transmitted from various regional stations, the radio may select the most powerful transmission.
The frequency selection keys required are key 5 (1) to activate the function and key 4 (2) to deactivate it.
When the function is activated the message "RES ON" is displayed; when it is deactivated the message "RES OFF" is displayed (see figure).

### Limiting the switch-on volume

The radio switch-on volume can be set using frequency selection keys 4 (1) and 5 (2) to increase or decrease the volume.
Press keys 4 or 5 to display the message "ONVOLxx" where xx stands for the volume that has been set (see figure).

### BOOSTER activation / deactivation delay (BDLY)

To activate or deactivate the Booster delay, press frequency selection key 4 (1) or 5 (2) respectively.
The display shows the message "BDLY ON" or "BDLY OFF" (see figure).

### Activation / Deactivation via the vehicle ignition switch.

See paragraph "Switching on the car radio".




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### Switching off the sound when the car phone is in use

To activate / deactivate the radio when a car phone system is installed on the vehicle, press frequency selection key 4 or 5 respectively.
The display shows the message "PHONE ON" or "PHONE OFF" respectively when the function is off or on.
When the function is on and a phone call is received, the car radio is automatically turned off and the speakers convey the call.

### Telephone input sensitivity

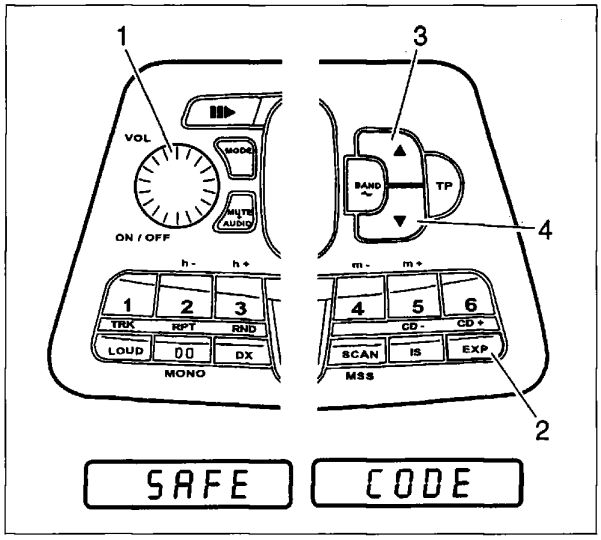
The telephone input sensitivity can be adjusted using frequency selection key 4 or 5.
The display shows the message "PHONE 00" or "PHONE 03" respectively for a low or high sensitivity.

### Adjusting the volume depending on the speed

For reasons of road safety this adjustment must only be carried out by qualified personnel.

### Activating the code

See paragraphs on theft protection below.




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### THEFT PROTECTION

The radio comes with a theft protection system comprising of a segret 4 digit code.
The protection system makes the rdaio inoperable if it is removed from the facia as a result of a theft.

### Secret code

The secret 4 digit code is shown on the "Security Code Card" which comes with the vehicle "Fiat Code Card". The secret code must be kept in a safe place (e.g together with the car documents) but **not inside the car.**

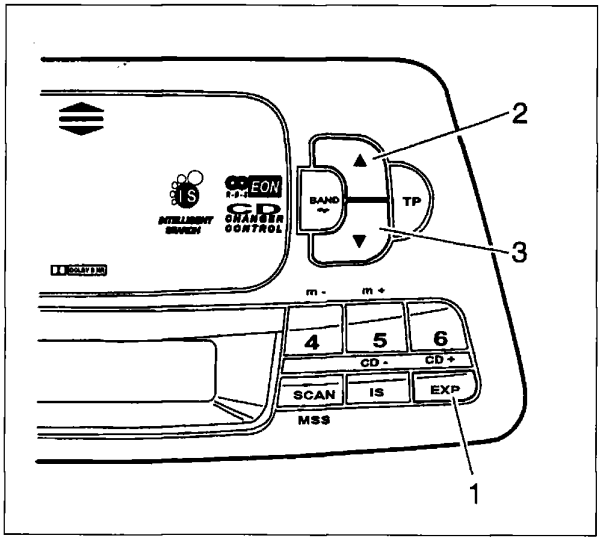
### Inputting the secret code for the first time

Switch on the radio using the VOL (1) knob
Press key EXP (2) and press keys "▲" "▼" (3,4) until the display shows the message "SAFE" or "CODE" (SAFE if the code is active, CODE if it is not active).
Input the code using frequency selection keys 2,3,4,5.
If for example the code is 1703 press the following frequency selection keys:
press key 2 once for the number 1, the display shows "1---"
press key 3 seven times for the number 7, the display shows "17--"
press key 4 once for the number 0, the display shows "170-"
press key 5 three times for the number 3, the display shows the complete code.
Once the code has been set, confirm it by pressing the EXP (2) key until the message "SAFE" is displayed.
The code is then switched on.
To switch off EXPERT press EXP key (2) until the message "EXIT" is displayed.

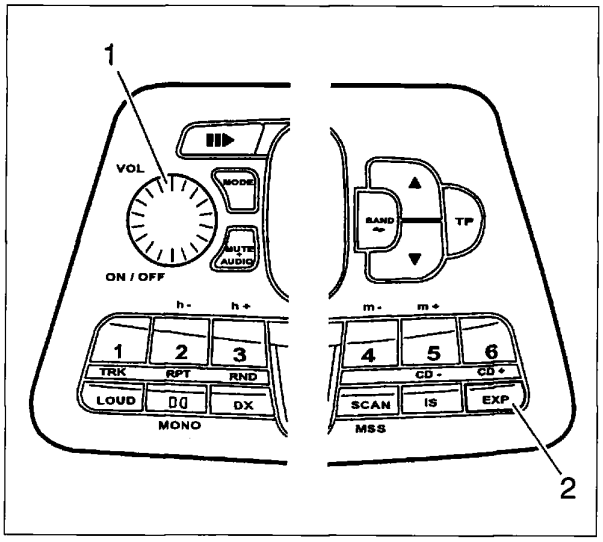
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### Deactivating the code

The code must be deactivated before removing the radio.
To deactivate the code, proceed as follows:
Press key EXP (1) and press keys "▲" "▼" (2,3) until the message "SAFE" is displayed.
Press frequency selection key 2 (4); the message "I----" is displayed.
Input the code as shown in the previous example.
Confirm the code by pressing key EXP until the message "CODE" is displayed.
The code is no longer active.
If the wrong code is inputted, the message "SAFE" is displayed; to deactivate the code, repeat the entire procedure.

### Reactivating the car radio by inputing the code

If the car radio is disconnected from the positive supply when the security code is active, the radio is protected electronically. To use the radio again the code must be entered as follows:
Switch on the radio using the VOL knob (1); the message "SAFE" is displayed followed by "I------".
Enter the code using the previous example.
Confirm the code by pressing the EXP key (2).
The radio switches on after about 3 seconds.

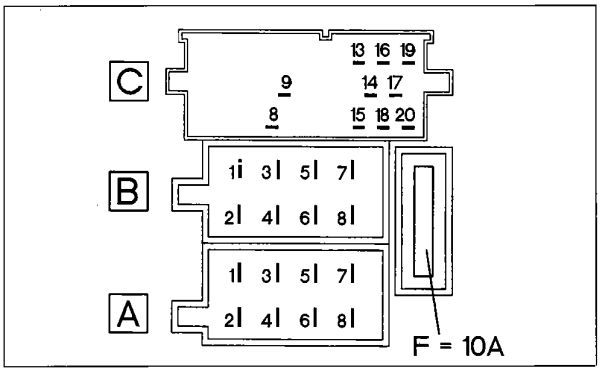
If the wrong code is entered, the message "SAFE" is displayed again. To enter the correct code repeat the procedure again from the start when the standby period is over.
After every mistaken attempt the car radio system starts a standby period during which the radio does not respond to commands. The standby times are:
1° attempt standby time 21 seconds
2° attempt standby time 1.5 minutes
3° attempt standby time 5.5 minutes
4° attempt standby time 22 minutes
5° attempt standby time 1.5 hours
6° attempt standby time 6.4 hours
7° attempt standby time 24 hours
8° attempt standby time 24 hours
The radio must not be switched on during the standby time.




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## CONNECTIONS

### Partial view of car radio rear section




F = Safety fuse

| CONNECTOR A HOUSING | |
|---|---|
| No. | Connection |
| 1 | Speedometer signal |
| 2 | Telephone "MUTE" signal |
| 3 | NC |
| 4 | Ignition activated (+15) |
| 5 | Supply aerial |
| 6 | Lights |
| 7 | Supply (+30) |
| 8 | Right dashboard earth |

| CONNECTOR B HOUSING | |
|---|---|
| No. | Connection |
| 1 | + Right rear speaker |
| 2 | - Right rear speaker |
| 3 | + Right front speaker |
| 4 | - Right front speaker |
| 5 | + Left front speaker |
| 6 | - Right front speaker |
| 7 | + Left rear speaker |
| 8 | - Left rear speaker |

| CONNECTOR C HOUSING | |
|---|---|
| No. | Connection |
| 7-12 | Microphone connection. |
| 8-9 | Connection for controls on steering wheels |
| 13 | CD data input |
| 14 | NC |
| 15 | CD Earth |
| 16 | + CD supply |
| 17 | + Service |
| 18 | CD AF Earth |
| 19 | Left CD channel |
| 20 | Right CD channel |

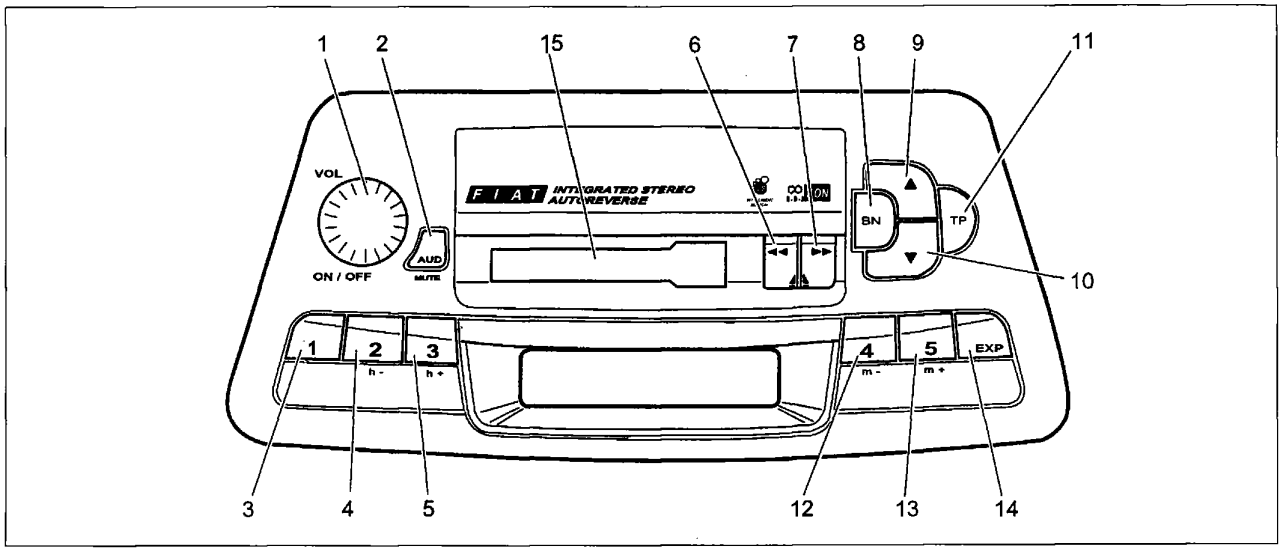
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# 55.

CAR RADIO TAPE PLAYER MODEL AS 182 M




4A61HL01

1. VOL button: switch on/off car radio, adjust Bass, Treble, Balance, Fader.
2. AUD-MUTE button: select Bass, Treble, Balance and Fader functions, activate MUTE.
3. Station store button N1.
4. Station store button N2, to set the time.
5. Station store button N3, to set the time.
6. Cassette rewind button.
7. Cassette fast forward button.
8. BN button: select frequency range FM1, FM2, FM3, MW; start automatic IS function, select AUTOSTORE function.

9-10. IS memory recall, automatic RDS station search, manual station tuning, set PTY programme type, select adjustment type from EXPERT menu.

11. TP button: select TP function; select alternative AF frequency; activate PTY function.
12. Station store button N4: adjust EXPERT settings.
13. Station store button N5: adjust EXPERT settings.
14. EXP button: activate EXPERT level control.
15. Cassette compartment.




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## GENERAL DESCRIPTION

The comes comes equipped with a car radio system with the following main components:
- radio-cassette player (non-removable) model AD 182 M that inserts into the previous radio slot in the center of the instrument facia and the customised front panel integrates fully with the facia line.
- 4 speakers of which 2 are placed sideways on the upper part of the instrument facia, the other 2 are placed on the interior panels of the front doors as per the previous system.
- stylus type aerial on the front central section of the roof.

Radio-Cassette player model AD 182 M is equipped with the following functions:

### Radio select

- PLL Tuning with frequency bands FM/MW/LW
- RDS(RADIO DATA SYSTEM) with TP (Traffic Program) functions - EON
- Automatic/manual station tuning
- Manual storage of 5 stations in bands FM1, FM2, FM3 and in bands MW and LW
- Automatic station storage using Autostore function on buttons 1,2,3,4,5 in bands FM1, FM2, FM3, MW and LW
- Automatic IS tuning and search

### Cassette section

- Autoreverse
- Tape fastforward and rewind

### Audio section

- Loudness function
- Mute Function
- Pause function
- Individual controls for adjusting bass and treble
- Left/right and front/rear channel balance
- Radio on/off system select
- TP function volume level presetting

### Clock section

- Hour/min adjustment

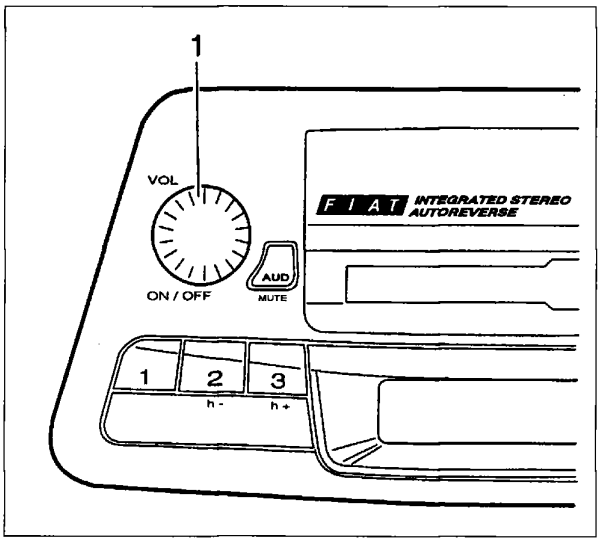
### Expert control level section

- Time set
- RDS synchronisation with Time
- Minimum volume for LRN traffic information
- Regional programme automatic change
- LOC function
- MONO function
- LOUDNESS function
- FADER function
- Switch-on volume limit
- BDLY function
- Switch/on off at same time as vehicle ignition
- Audio cut-off when car phone operating
- Telephone input sensitivity

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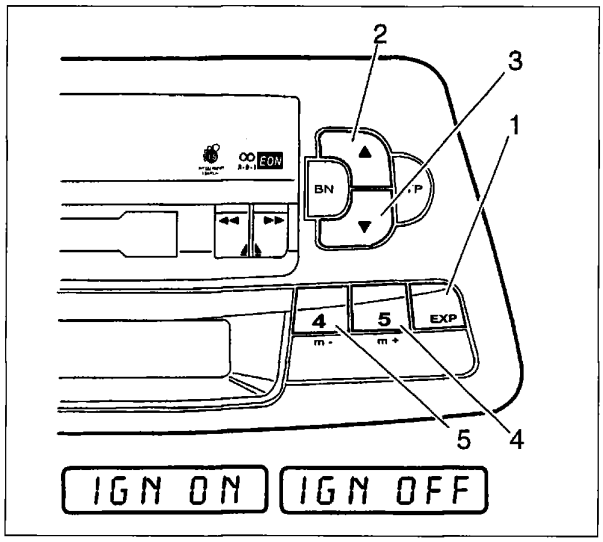
### Operation

### Switching on radio

Press the VOL (1) button once to switch on the car radio. If the car radio is switched on when the engine is not running it will automaticaly switch off after about 20 mins.

### Switching on/off when the engine is started/stopped

The car radio has a switch-on system that, if activated, switches on/off the car radio at the same time as the engine is started/stopped.
If the system is active the car radio will switch on/off when the engine is started/stopped.
If the system is not active: starting/stopping the engine does not switch on/off the radio.




4A63HL02

Press the EXP (1) key for about 3 seconds until the message "EXPERT" is displayed.
Select the switch on/off via ignition switch setting using the keys "▲" (2) and "▼" (3).
Press frequency selection key 5 (4) to activate the function or if already active press frequency selection key 4 (5) to deactivate.
The display shows the messages "IGN" and "IGN OFF" respectively when the function is active or inactive.

**NOTE** *The procedure described above must be carrie dout with the engine running.*

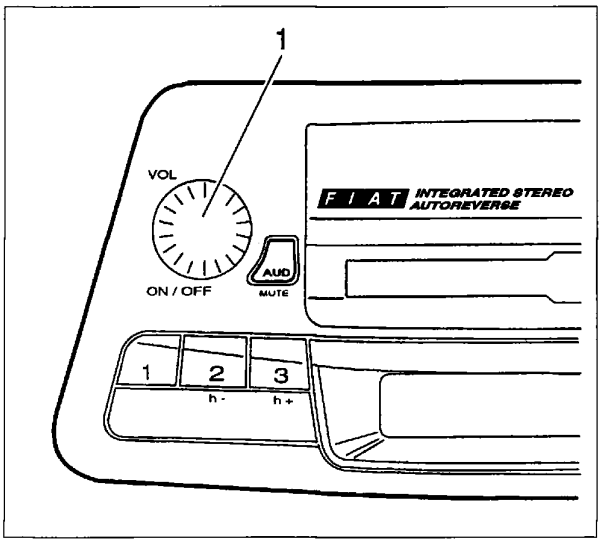
If you want to switch on the radio after it has been switched off via the engine ignition switch then press the VOL knob.

### PAUSE function

When listening to a Cassette or a Compact Disc, if the Radio function is selected then playback is interrupted. When you return to "Cassette" mode, playback continues from the point where it was interrupted. If you select the Cassette function while listening to the radio, on returning to Radio mode, you will be tuned to the most recent station selected.



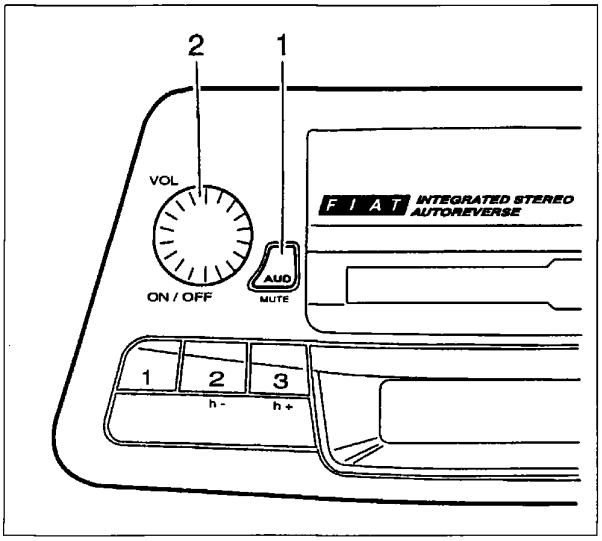

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### VOLUME adjustment

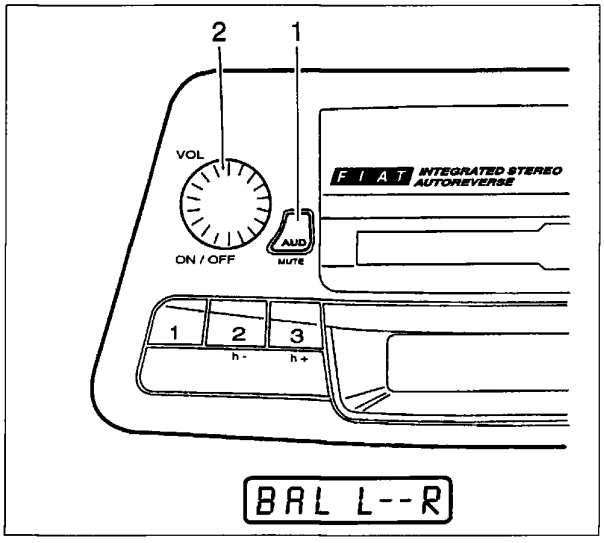
Use the VOL knob (1) to adjust the volume.
The volume level, between "VOL 00" and "VOL 31", appears on the display when the volume is being adjusted.




4A64HL02

### BASS and TREBLE adjustment (BASS and TREBLE)

Select the "Bass" or "Treb" function by pressing the AUD (1) button.
Once the function has been selected, use the VOL /(2) knob to achieve the required sound.
To restore the default setting, press the AUD button for about 3 seconds until the message "00" or " " appears on the display.




4A64HL03

### Adjusting balance between left and right speakers (BALANCE)

Balance refers to the "volume ratio" between the left and right speakers. To adjust , press the AUD (1) button a few times until the "BALANCE" function is selected. The message "BAL L- -R" appears on the display Use VOL (2) knob to adjust the balance as required. The selectable values range from 0 to 15.
To restore the default settings, press the AUDIO button for about 3 seconds until the message "00" or "--" appears on the display.



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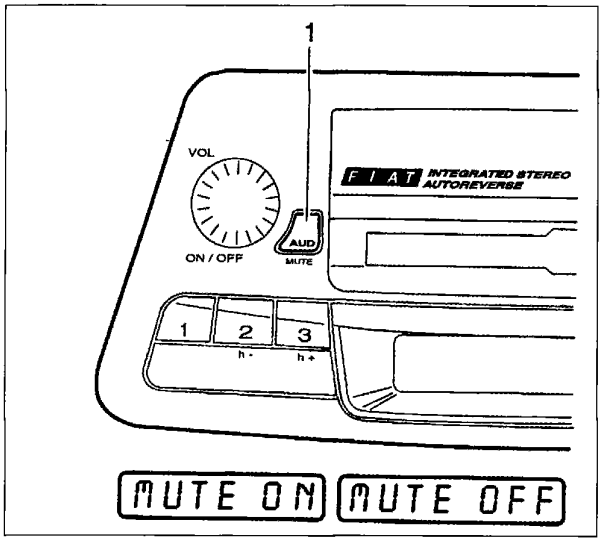
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### Adjust balance betwen left and right speakers (FADER)

To adjust consult section "EXPERT level control" and the relevant heading "FADER Function".

### Loudness function

To adjust consult the section "Expert control level" and the relevant heading "LOUDNESS function".




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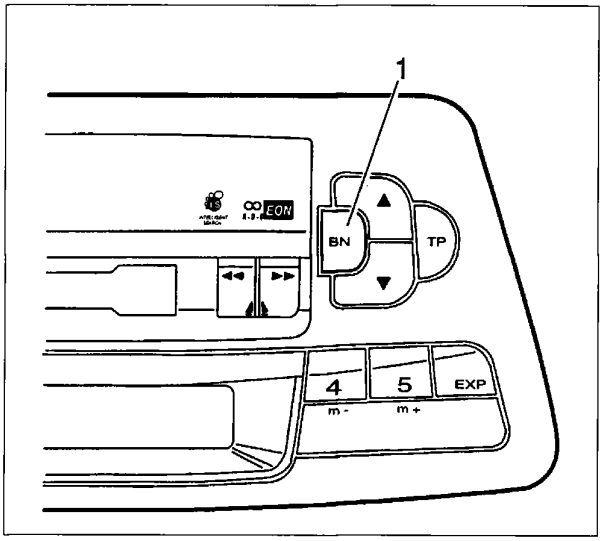
### MUTE function

Press AUD (1) button for about 3 seconds to select the MUTE function and to display the message "MUTE **ON**".
To deactivate this function press the AUD key again. The mesage "MUTE **OFF**" is displayed.
When the Mute function is selected, the radio no longer sends signals to the speakers.

## RADIO FUNCTION

*The reception conditions will vary greatly while driving. Reception can be affected by mountains, buildings or bridges especialy when far away from the transmitter of the station you are listening to.*

**NOTE** *When you activate the "RADIO" function, the station listened to just before switching off the radio will be received.*




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### Function selection

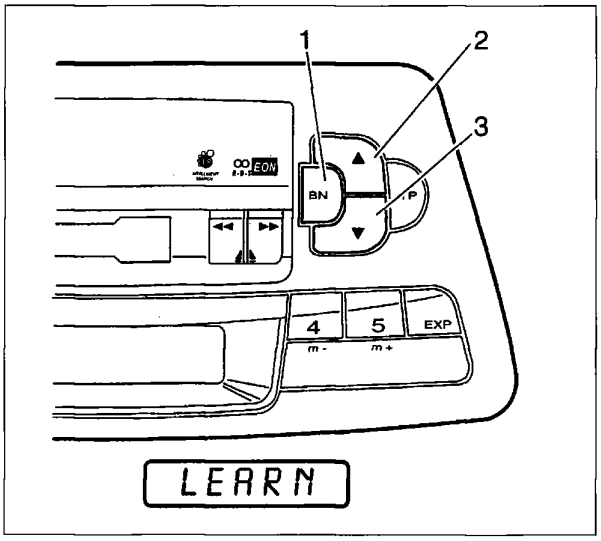
As soon as car radio is switched on, the radio will come on.

### Band selection

Press key **BN** (1) to select the range of frequencies available The range selected appears on the display The possible messages are:
"FM1", "FM2", "FM3" for FM frequencies.
"MW", medium wave, "LW", long wave for AM frequencies.




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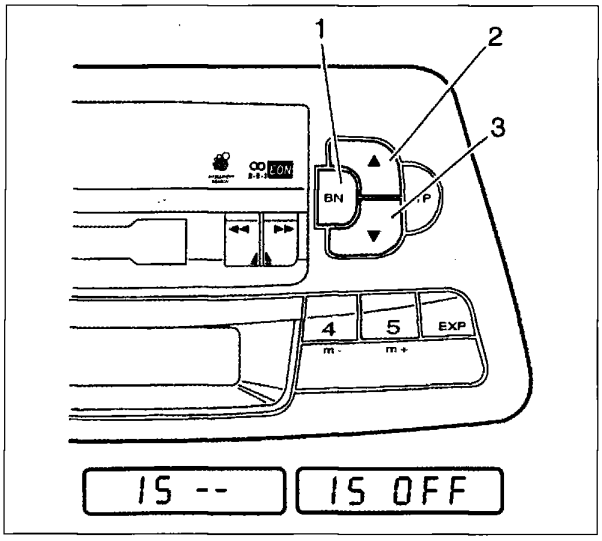



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**Tuning and intelligent automatic search (IS Function)**

Use key BN (1) to select band "FM1", "FM2" or "FM3".
Press BN key (1) to start the search; the mesage "LEARN" appears on the display.
When the searchis ended, the RDS programmes are stored in the car radio IS memory first followed by the stations depending on their transmission strength. Up to 30 stations can be stored in the IS memory. If no station can be received, the reception remains active; to stop it press one of the station selection keys (1,2,3,4,5).

To recall the stations stored in the IS memory, select operating mode IS by pressing key "▲" or "▼" (2,3) for about three seconds until the message "IS--" is displayed followed by "IS ON" Use key "▲" or "▼" to progressively recall the stored stations.
To deactivate the IS function, press key "▲" or "▼" for about three seconds until the mesage "IS OFF" is displayed.




4A63HL02

RDS automatic tuning and search.

Select the frequency FM or AM band required using the BN key (1).
THe IS function should not be active for this function.
If the IS function is active, press key "▲" (2) or "▼" (3) for about three seconds until the message "IS--" is displayed followed by "IS OFF".
Press key "▲" (2) or "▼" (3) to start the automatic search. When a station with an identification code is found (RDS station) the code will be displayed. If you want to store the station on one of the selection buttons (1,2,3,4,5) press the preselected key for about 2 seconds. The car radio will turn off the sound until the storing process is complete.

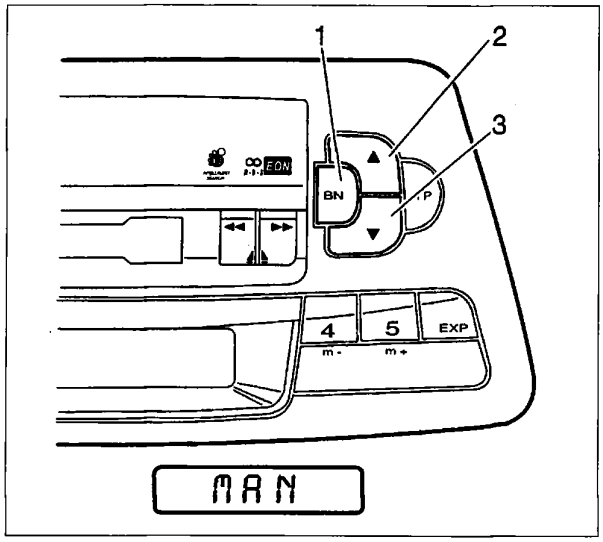


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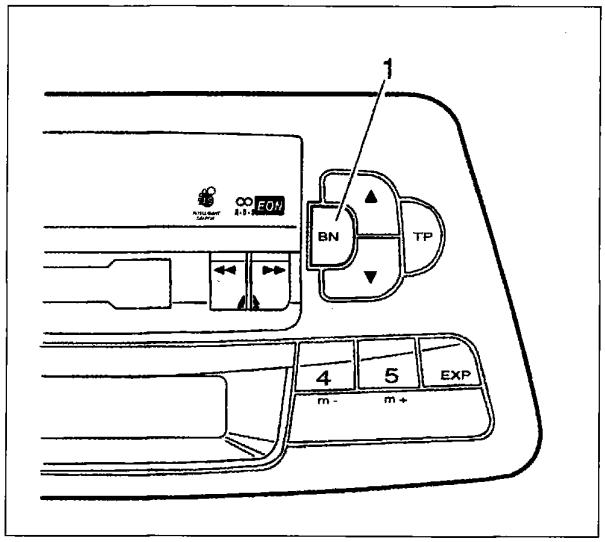
Tuning and manual storing of a station.

Select the frequency band by pressing key BAND (1). The display shows the selected band: "FM1", "FM2", "FM3", "MW" or "LW".




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Once the band has been selected, press key "▲" or "▼" (2,3) for about six seconds until the message "MAN" and the frequency the radio is tuned to are displayed. Use keys "▲" or "▼" to change the tuning frequency in 50 Hz steps for FM bands and 1khz for AM.
The station you are listening to can be stored in the frequncy band selected using the frequency selection keys. When the storage process is finished, press the preselected frequency selection key until the sound comes on again.
Manual tuning can be ended at any time by pressing one of the frequency selection keys or by not pressing any key for 60 seconds.




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### Listening to stored stations.

Select the required band using key BN (1) Press one of the frequency selection keys.
The display shows the key that has been pressed and the station code if it is an RDS station.
If the selected station has an RDS service and the reception is poor, the car radio will search for an alternative frequency. During the search for an alternative frequency, the message "SRC" is displayed.

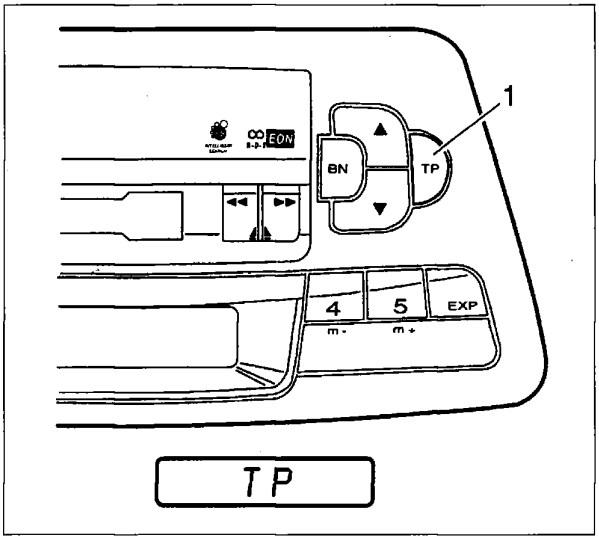
### TP Function (Traffic Program)

Some station in bands RDS1 and RDS2 also broadcast traffic reports.
The TP (Trafic Program) can be used to:
a) search only for RDS stations with traffic reports;
b) receive traffic report even if a cassette is playing;
c) receive traffic reports at a minimum preset level even if the voulme is at zero.

**NOTE** *Below are instructions for carrying out the operations illustrated in points a), b) and c) described above.*




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Point a)

To select a station with traffic reports press key TP (1). The message "TP" is displayed.
If the initial station does not provide traffic reports, the radio automatically tunes to the closest station that does have them.
A number of stations with traffic reports can be stored using the station selection keys. To do this, follow the instructions found in the paragraph headed "Manually tuning and storing a station" after pressing the TP key to activate the TP function.
As an alternative to manual storage, follow the instructions found in the paragraph headed "Automatic station storage (AUTOSTORE)".

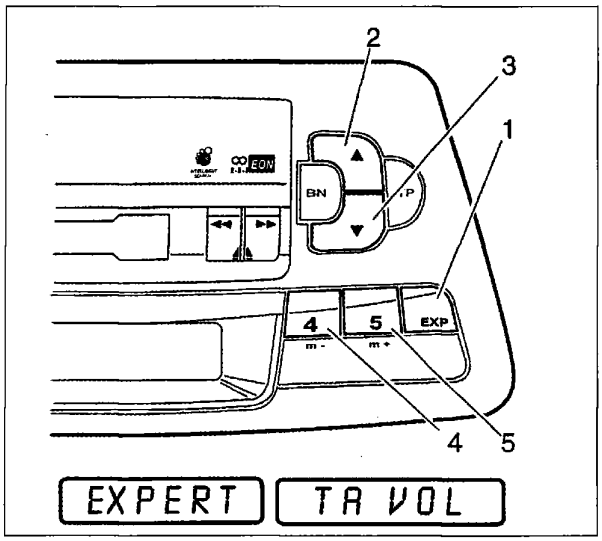
Point b)

If you want to receive traffic information, befor inserting the cassette tune to an RDS, TP station If traffic information is broadcast on this station, the cassette playback will stop and will automatically start again when the report is finished.

Point c)

Trafic information can also be received when not listening to the radio. If you tune to an RDS TP station the set the volume to zero, traffic reports from that station will be heard at the preset volume.

*in some countries, certain radio stations will not broadcast traffic reports despite having an active TP function.*




4A68HL02

TP (Traffic Program) function volume level preset

To select the traffic report volume, press the EXP key (1) until the message "EXPERT" is displayed. Then press keys "▲" or "▼" until the message "TA VOL" is displayed. Use keys 4 (4) and 5 (5) to select the required volume. The volume can vary between 5 and 31.



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### EON (Enhanced Other Network) Function

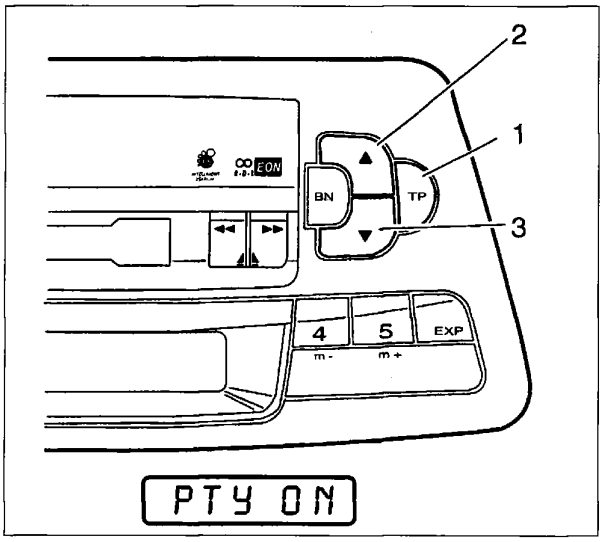
In some countries a circuit is active that groups together stations that transmit traffic reports.
In these cases, the RDS TP station broadcast will be interrupted to receive traffic reports if these are transmitted by a station in the same circuit.
To exclude the EON function, press the TP (1) button; the LED under the button will switch off.

### PTY function

Some radio stations offer the "Programme type" (PTY) function in the FM band. The PTY function can be used to automaticaly select a station that offers a particular type of programme eg classical music.

### Automatic PTY search

The search can be carried out by assigning 5 types of program selected by you, to the station selection keys (1,2,3,4,5) or by selecting the type of programme from the stored list and then starting the search.
Refer to the paragraphs below for further details.




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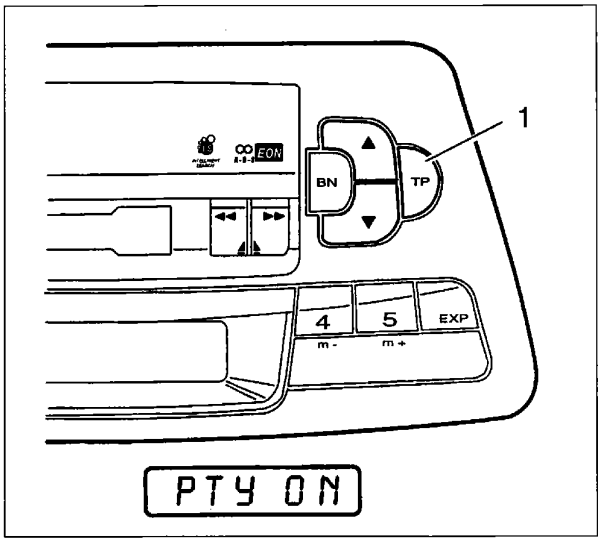
**Storing the types of programme required on the station selection buttons**

Press button TP (1 on above figure) for about 6 seconds until the message "PTY ON" is displayed Select the type of programme required using keys "▲" (2), "▼" (3).
Once you have found the programme type you want eg classical music "CLASSIC", press the station selection button (1,2,3,4,5) required, for more than two seconds. The button that you press will then have the selected programme assigned to it.

Every station can be assigned a programme type by repeating the above procedure.
To start the automatic search for a station that transmits a particular type of programme, press the TP (1) button again for about 6 seconds. The message "PTY ON" appears on the display. Then press the station selection button for the type of programme required. The selected programme type is displayed. The automatic search can be started by pressing buttons "▲" (2), "▼" (3) for about 2 seconds. The search stops when a station that transmits the type of programme requested is found.



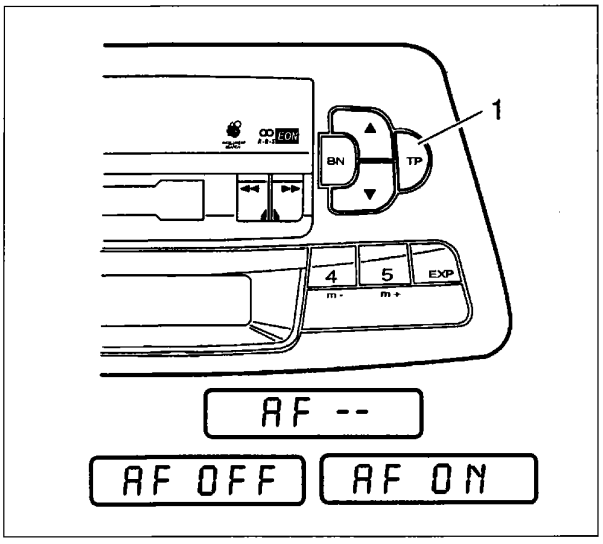

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List of available programme types

NEWS: News programmes and current affairs
AFFAIRS: Politics and events
INFO: Special information programmes
SPORT: Sports transmissions
EDUCATE: Training and study
DRAMA: Radio plays and literature
CULTURE: Culture and religion
SCIENCE: Science programmes
VARIED: Programmes with varied content
POP: Pop Music (hits)
ROCK M: Rock Music
EASY: Easy listening
LIGHT M: Classical easy listening
Classics: Classical Music
OTHER M: Music programmes that cannot be classified eg folklore




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Tuning to the type of programme using the list

Activate the TPY function by pressing the TP button (1) for about six seconds until the message "PTY ON" is displayed.
Keep pressing buttons "▲","▼" (2,3) to progressively display the programme types available from the list Identify the type of programme required then press key "▲ " or "▼ " for about 2 seconds to start the automatic search. The search stops when the radio tunes to the selected programme type.

WEATHER: Weather forecasts
FINANCE: Financial News
CHILDREN: Transmissions for children
SOCIAL: Social information
RELIGION: broadcasts Philosophical and religious
PHONE IN: Phone in programmes
TRAVEL: Tourist travel information
LEISURE: Free time , hobbies and pastimes
JAZZ: Jazz Music
COUNTRY: Country Music
NATIONAL: National transmissions.
OLDIES: Golden Oldies
FOLK M: Folk Music
DOCU: Special reports
NO PTY: No identification code for type of programme

Alternative frequency (AF)

If an RDS programme comes is transmitted by more than one station, using different frequencies, then the radio automatically selects the clearest frequency.
The function is activated at the moment of supply. To deactivate the AF function press the TP button (1) for about 3 seconds until the message "AF--" appears on the display followed by "AF OFF". To activate the AF function again press the TP button until the message "AF OFF" is displayed followed by "AFF ON".

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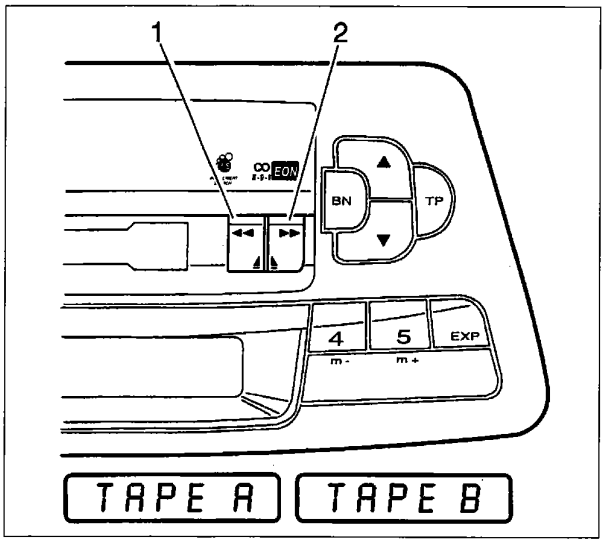

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# 55.

## CASSETTE PLAYER

### Activating the cassette player

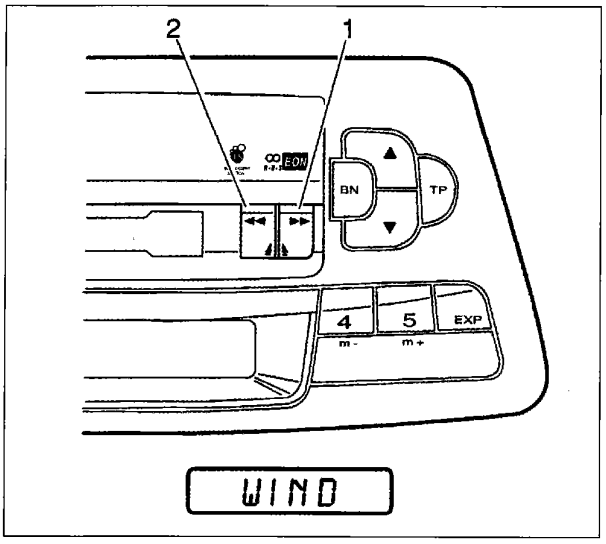
The car radio comes equipped with a cassette player which is turned on by inserting a cassette directly into the cassette compartment.
The player allows you to listen to both side of the cassette without removing the cassette to turn it over.
Insert the cassette as far as it will go, keeping your hand on it until the car radio draws it in automatically and starts the playback.




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### Changing cassette side

With a cassette inserted into its compartment and the message "TAPE A" or "TAPE B" being displayed, press keys (1) and (2) together.
The cassette player plays the other side of the tape.
The messages "TAPE A" and "TAPE B" refer to the upper and lower sides of the tape.



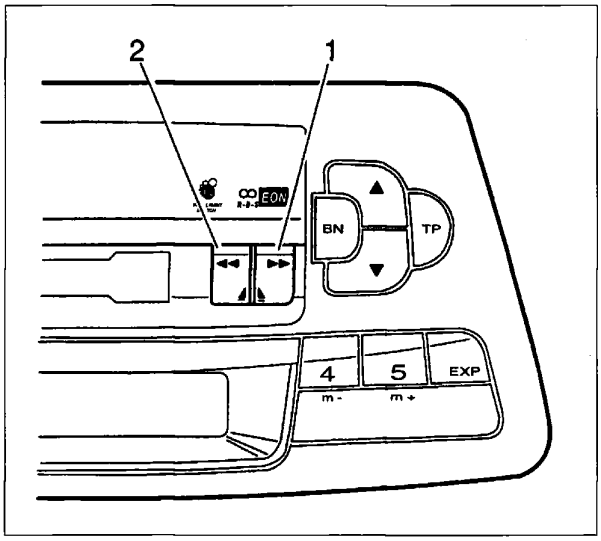

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### Fast forward / rewind

During playback press key (1) or (2) to respectively fast forward or rewind the tape. The message "WIND" is displayed during this operation. To stop this function briefly press key (1) or (2). Once the function is stopped, the cassette player automatically restarts the playback of the cassette.
When the tape is fully rewound or wound the player automatically starts the playback of, respectively, the same side or the reverse side of the cassette.




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### Ejecting the cassette

To eject the cassette from the cassette compartment press keys 1 and 2 at the same time. When the tape has been ejected, the message "TAPE" appears on the screen and the radio switches on, tuned to the most recent station listened to.

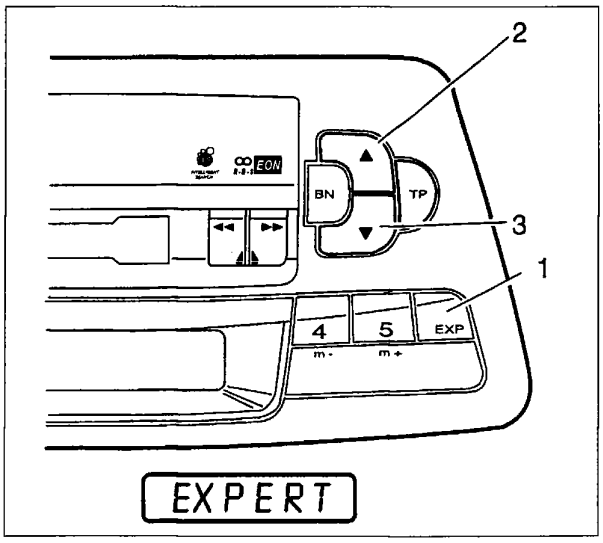
### EXPERT control level

Using the supplementary EXPERT level, a number of adjustments can be made that only need to be carried out once e.g. setting the exact time, or only need to be adjusted on occasionaly eg setting the minimum volume for traffic reports.

### List of possible EXPERT adjustments

The following adjustments can be carried out using the EXPERT control level:

1. Time set
2. Switch on / off watch RDS synchronisation
3. Traffic report minimum volume
4. LRN switch on / off
5. Switch on / off automatic regional program change
6. LOC on/off
7. MONO on/off
8. LOUDNESS on/off
9. FADER on/off
10. Limit switch on volume
11. Connected BOOSTER switch on/off delay BDLY
12. Switch on / off using vehicle ignition switch.
13. Cut off sound for car phone operation.
14. Phone input sensitivity




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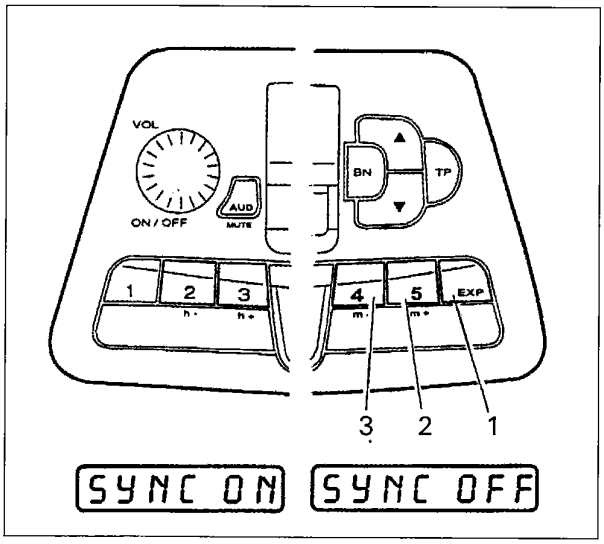
Select and modify the settings using EXPERT control level.

Press key EXP (1) until the message "EXPERT" is displayed.
Select the adjustment you want to make using keys "▲" (2) and "▼" (3). Press the appropriate frequency selection keys to set the required level.
The frequency selection keys used depend on the adjustment you want to make.
To identify them, refer to the following paragraphs relating to the individual adjustments possible.
To stop the adjustments, press the EXP key for about 3 seconds.

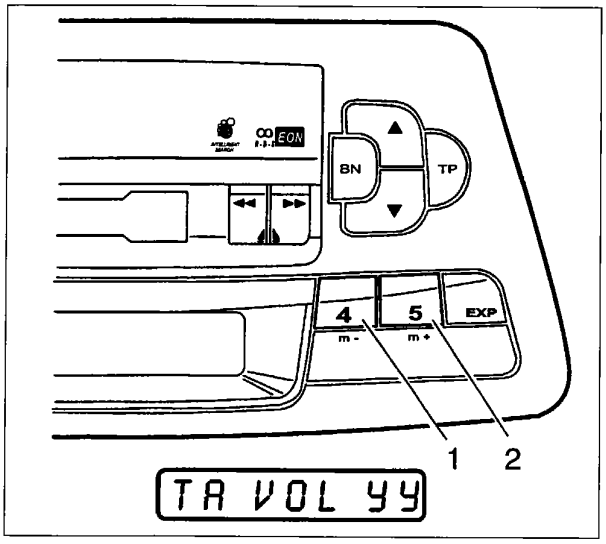


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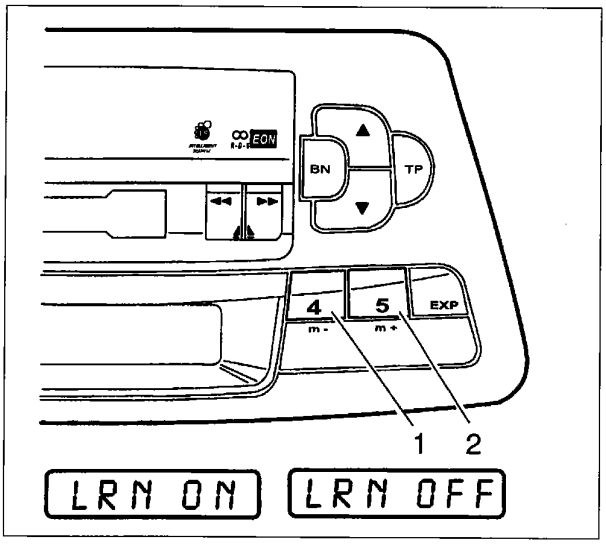
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### TIME setting

The frequency selection keys required for setting the time are:
Keys 2 and 3 for setting the hour.
Keys 4 and 5 for setting the minutes.
To start the clock precisely to the second press key EXP.

### Synchronising the watch

Allows the watch to be synchronised with RDS TIMER station signals:
Press frequency selection key 5 (2) to display the message "SYNC ON"; press frequency selection key 4(3)subsequently to display the message "SYNC OFF".

### Minimum traffic information volume

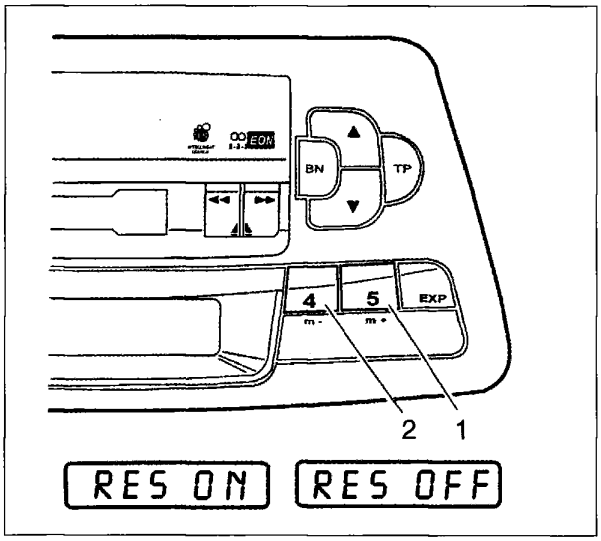
To set the required volume, use frequency selection keys (4) (1) and 5 (2) to respectively increase or decrease the volume.
During the adjustment the display shows the message "TAVOL YY" where YY stands for the volume level that has been set.

### Activation / Deactivation LNR (radio function)

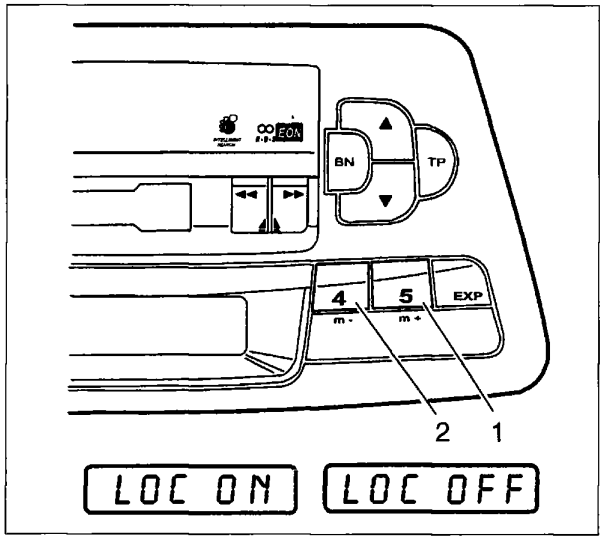
Activates / deactivates the search for RDS stations with traffic reports.
The frequency selection keys for activation / deactivation are keys 4 (1) and 5 (2) respectively.
The display shows the messages "LRN ON" and "LRN OFF" respectively when the function is activated or deactivated (see figure).



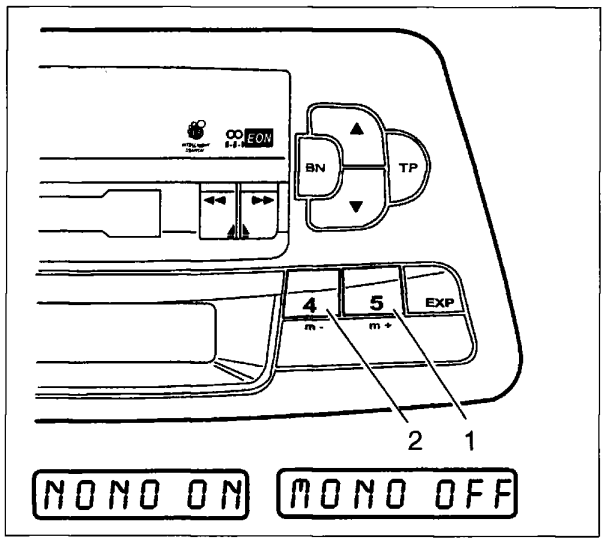

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4A74HL01




4A74HL02




4A74HL03

### Automatic program change (REGIONAL)

When the same RDS programme is transmitted from various regional stations, the radio may select the most powerful transmission.
The frequency selection keys required are key 5 (1) to activate the function and key 4 (2) to deactivate it.
When the function is activated the message "RES ON" is displayed; when it is deactivated the message "RES OFF" is displayed (see figure).

### LOC Function

Searches for FM frequencies based on their transmission strength.
If the LOC function is selected, the car radio searches for stations with high transmission strength whereas if the function has not been selected the search is extended to lower strength transmissions.
To activate the LOC function, press frequency selection key 5 (1) until the message "LOC ON" is displayed. To deactivate the function once switched on, press frequency selection key 4 (2) until the message "LOC OFF" is displayed.

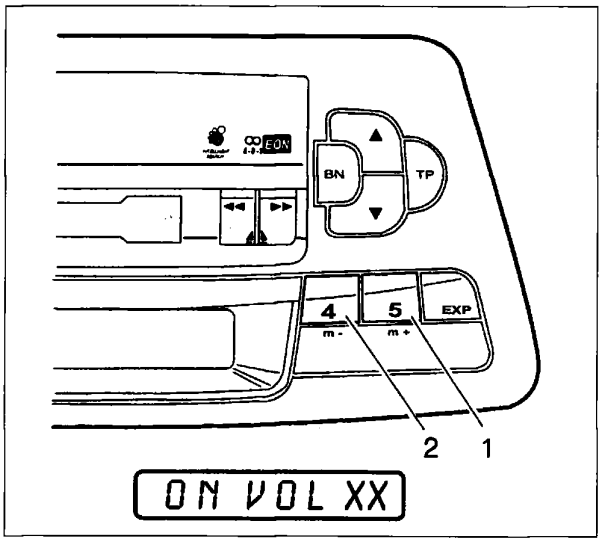
### MONO function

The MONO function allows you to set the car radio to stereo or mono mode. If the stereo transmission is selected, the sound comes from two different channels, whereas if MONO transmission is selected the sound comes from one channel. For good sound quality, choose a mode consistent with the type of transmission (Stereo or MONO). To select the MODE function, press frequency selection key (1) until the message "MONO ON" is displayed. To deactivate the MONO function press frequency selection key 4 (2) until the message "MONO OFF" is displayed.

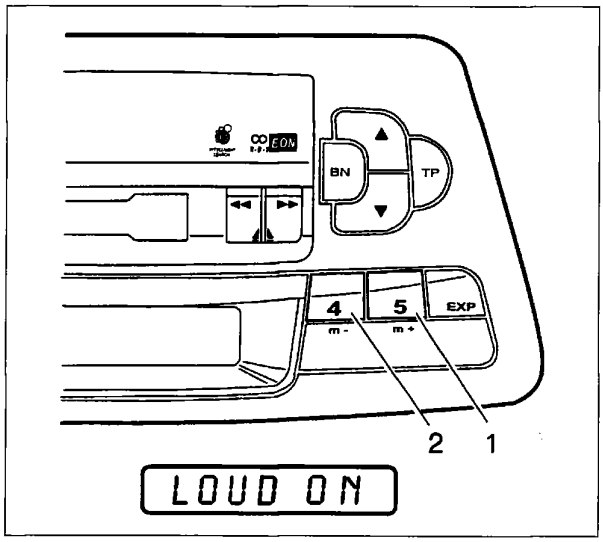


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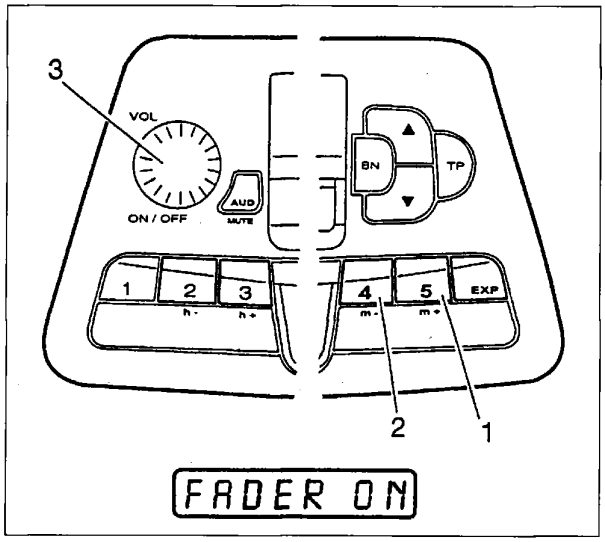
# 55.




4A75HL01




4A75HL02




4A75HL03

### Limiting the volume at start-up

The car radio start-up volume can be selected using frequency selection keys 5 (1) and 4 (2) to respectively increase or decrease the volume.
Press key 4 or 5 to display the message "ON VOL xx" where xx stands for the volume level set.

### LOUDNESS function

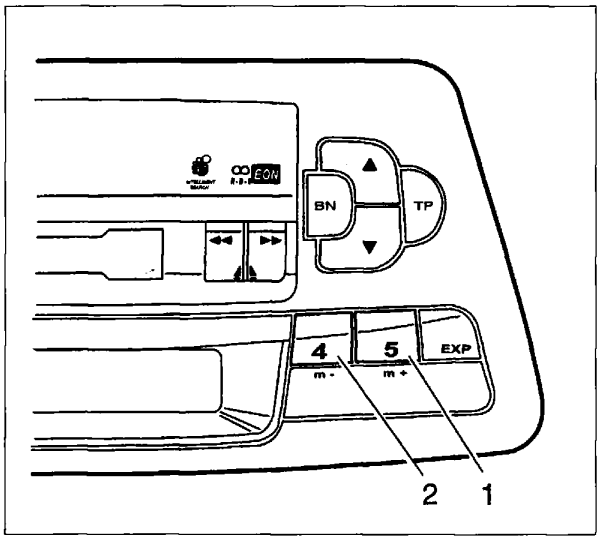
The LOUDNESS function allows you to improve the sound quality at low levels.
To activate the LOUDNESS function press frequency selection key 5 (1) until the messaage "LOUD ON" is displayed. To deactivate the LOUDNESS function once activated, press frequency selection key 4 (2).

### Funzione FADER

Select the FADER function to change the volume balance between front and back speakers.
To select the FADER function, press frequency selection key 5 (1) until the message "FADER ON" is displayed. To deactivate the function press frequency selection key 4 (2). Use the VOL knob (3) to change the volume of the sound, relatively increasing the sound from either the front or back speaker.




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4A76AH01

**BOOSTER activation / deactivation delay (BDLY)**

To activate or deactivate the Booster delay, press frequency selection key 5 (1) or 4 (2) respectively.
The display shows the message "BOLY ON" or "BOLY OFF".

### Activation / Deactivation via the vehicle ignition switch

See paragraph "Switching on the car radio".

### Switching off the sound when the car phone is in use

To activate / deactivate the radio when a car phone system is installed on the vehicle, press frequency selection key 4 or 5 respectively.
The display shows the message "PHONE ON" or "PHONE OFF" respectively when the function is off or on.
When the function is on and a phone call is received, the car radio is automatically turned off and the speakers convey the call.

### Telephone input sensitivity

The telephone input sensitivity can be adjusted using frequency selection key 4 or 5.
The display shows the message "PHONE 00" or "PHONE 03" respectively for a low or high sensitivity.

## TECHNICAL INFORMATION

### Aerial

The car is fitted with a stylus aerial on the roof panel.

### Electric aerial and exterior amplifier (available on request)

The car radio is fitted with the wiring for controlling an automatic electric aerial that rises when the car radio is switched on and lowers when the radio is switched off).

The switch voltage for the antenna is found on contact 5, connector "A" of the car radio and the switch voltage for the amplifier is found on contact 3 of connector "a".

The switch voltage for both outputs is +12 V with a maximum current of 0.5 A.

### Speakers for radio system AD182H

The sound system comprises of:
- 2 tweeter-dome ferrofluid speaker, 40 W max. each.
- 2 130 mm speakers, 40 W max each.

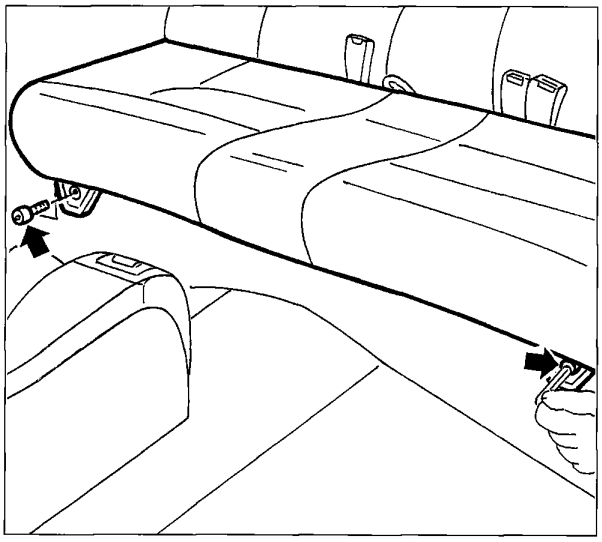
### Fuses

The car radio has a 10A protection fuse.

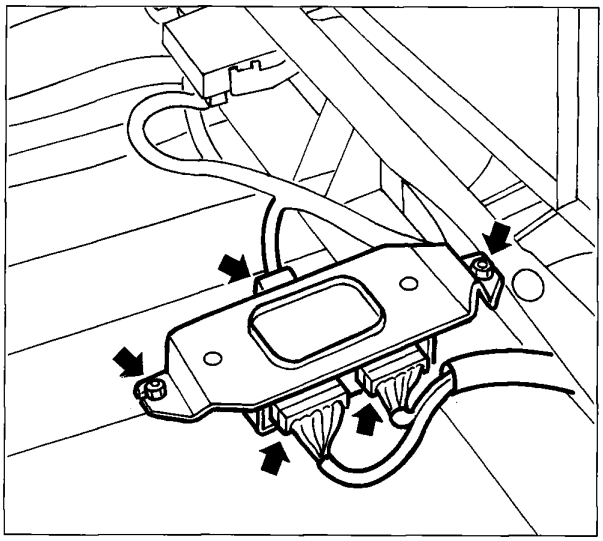


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# 55.



4F040M01



4F054GL02

### SERVICES CONTROL UNIT R&R

Marea

- Undo the bolts retaining the rear seat cushion to the bodyshell, then remove it from the car.

Marea Weekend

- Disconnect the rear seat cushion.

- Undo the two retaining bolts.
- Remove the control unit from its housing after disconnecting the three connectors.

**NOTE** *To refit, follow the removal procedure in reverse.*

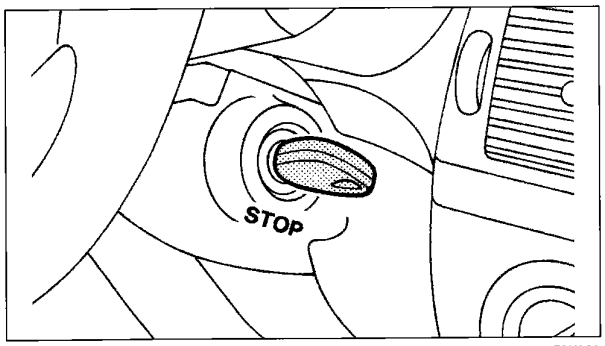



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## PROGRAMMING THE IGNITION KEY (only on 1910 JTD versions)

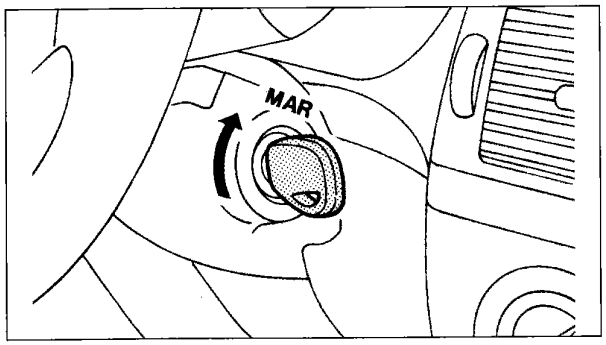
**For any subjects not dealt with in the following pages, refer to the Fiat CODE system described in the Service Manual for the Fiat Marea-Marea Weekend volume 2 (print no. 506.761/01**

*In order to change the software configuration for the CODE system, follow the special procedure below.*
*As well as the MASTER keys, you must also have two other main keys.*



4A79HL01

Insert the MASTER (red) key in the **OFF** position.



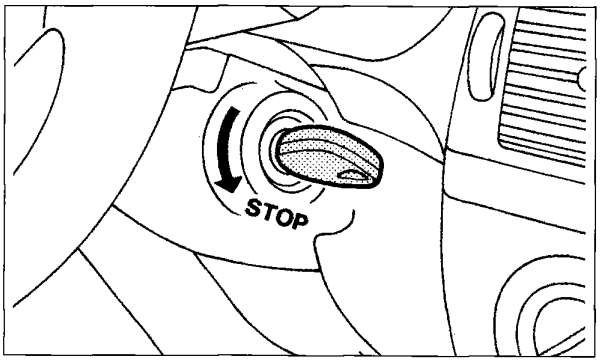
4A79HL02

Rotate the MASTER key to the **ON** position (+15). The CODE light will switch on for 0.7 secs.

*Copyright Fiat Auto*

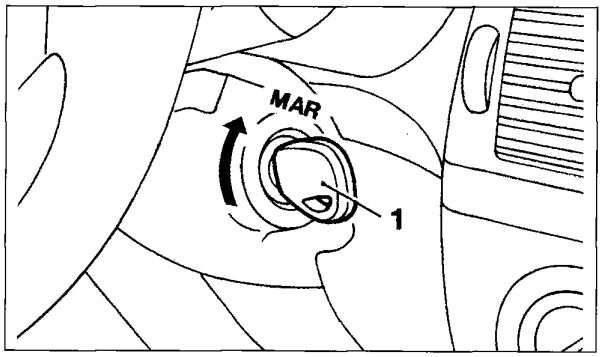

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# 55.



4A80HL01

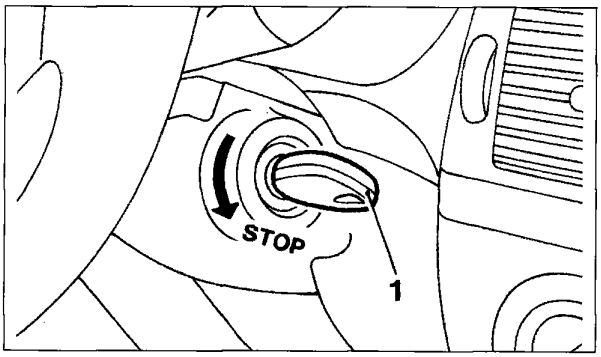
When the CODE light switches off, rotate the MASTER key into the STOP position and remove it.



4A80HL02

Within 10 seconds:

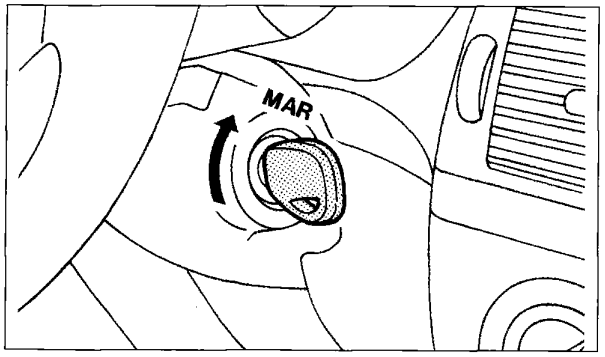
- insert a new key (1) into the ignition block and rotate to the ON position (+15); the CODE light will switch on for 0.7 sees.



4A80HL03

- When the CODE light switches off, rotate the key (1) into the STOP position and remove it.

Repeat the operations, as per key (1) for the second key and any other key you want to program.



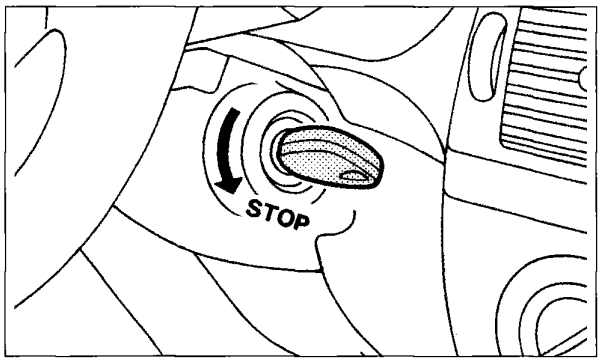
4A79HL02

Within 10 seconds:

- insert the Master key into the ignition block again and rotate into the ON position (+15): the CODE light will switch on for 0.7 secs.



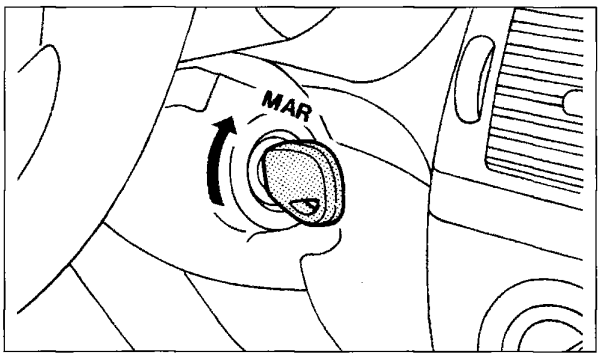
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4A80HL01

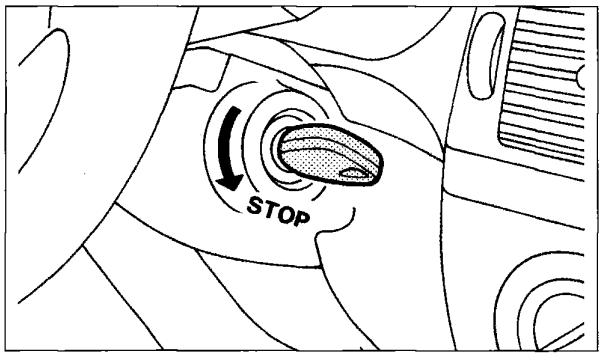
When the CODE light switches off, rotate the MASTER key into the OFF position an leave it there for between 4 and 9 seconds.

*Do not leave the MASTER key in the OFF position for more than 10 seconds as this would cancel all the stored codes.*



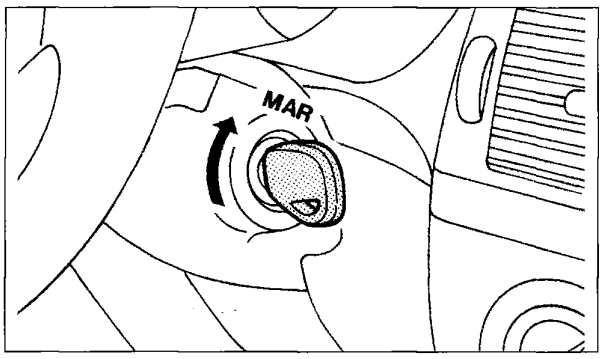
4A79HL02

Rotate the MASTER key into the ON position (+15); the CODE warning light will come on for 0.7 secs.



4A80HL01

When the CODE light switches off, rotate the MASTER key into the OFF position.



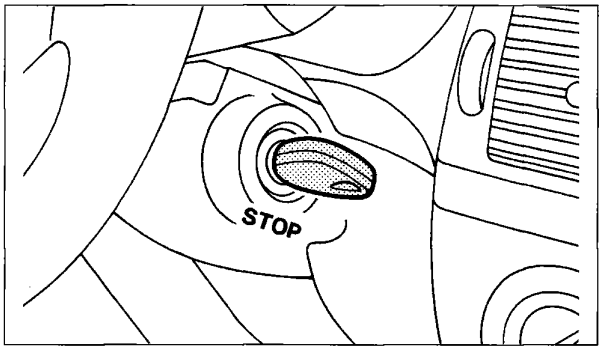
4A79HL02

Repeat the two operations above until the CODE light remains switched on when the MASTER key is rotated to the ON position, rather than remaining on for only 0.7 seconds.



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# 55.



4A79HL01

Rotate the MASTER key to the STOP position; remove then replace it; the programming procedure is finished.

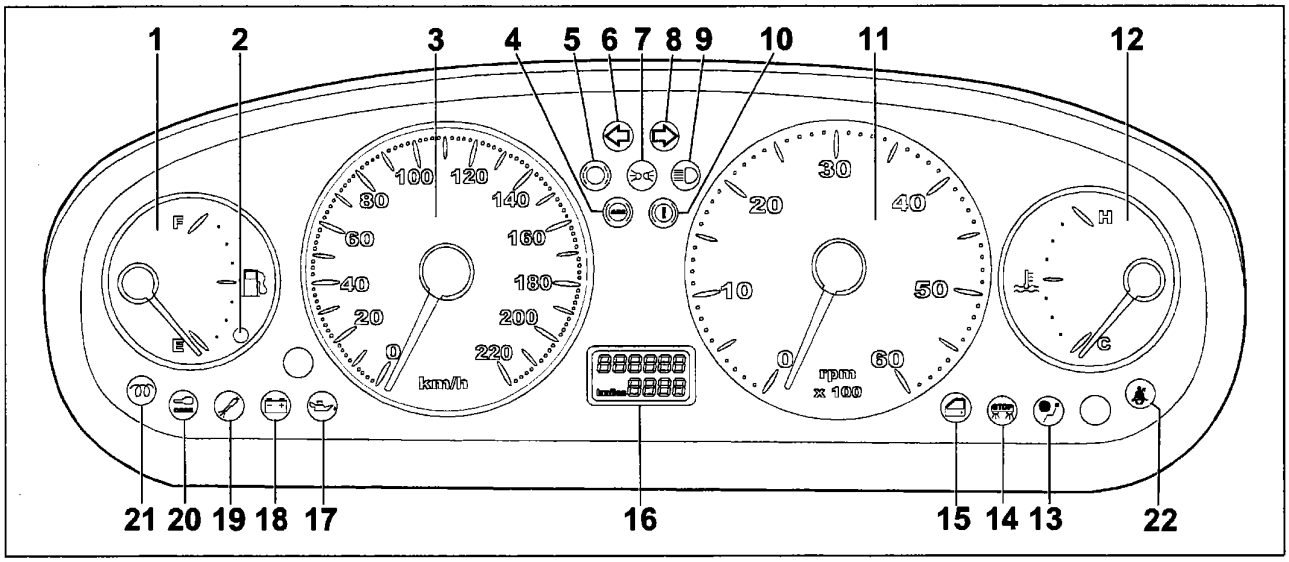
If the timing and operations of the procedure have been correct, the CODE light should switch off after 0.7 seconds when the key is rotated to the ON position, otherwise the light will start to flash rapidly (1.6 Hz) in which case you must repeat the programming procedure.

*If you think you have made a mistake during the programing procedure (at any stage), rotate the key to the ON position for more than 2 seconds or to the STOP position for more than 10 seconds then restart the key programming procedure.*



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## CONTROL PANEL (from November 1999)




4F059GL01

Front side

1. Fuel level gauge
2. Fuel reserve warning light
3. Speedometer
4. ABS system failure warning light
5. Brake pad wear warning light
6. Left direction indicator warning light
7. Side lights warning light
8. Right direction indicator warning light
9. Main beam warning light
10. Low brake fluid level and handbrake applied/EBD system failure warning light
11. Rev counter
12. Engine coolant temperature gauge
13. Air Bag fault warning light
14. Brake light failure warning light
15. Doors open warning ilght
16. Trip counter/mileometer/outdoor temperature gauge
17. Low engine oil pressure warning light
18. Generator warning light
19. Injection system failure warning light
20. FIAT CODE system warning light
21. Glow plug warning light
22. Seat belt warning light

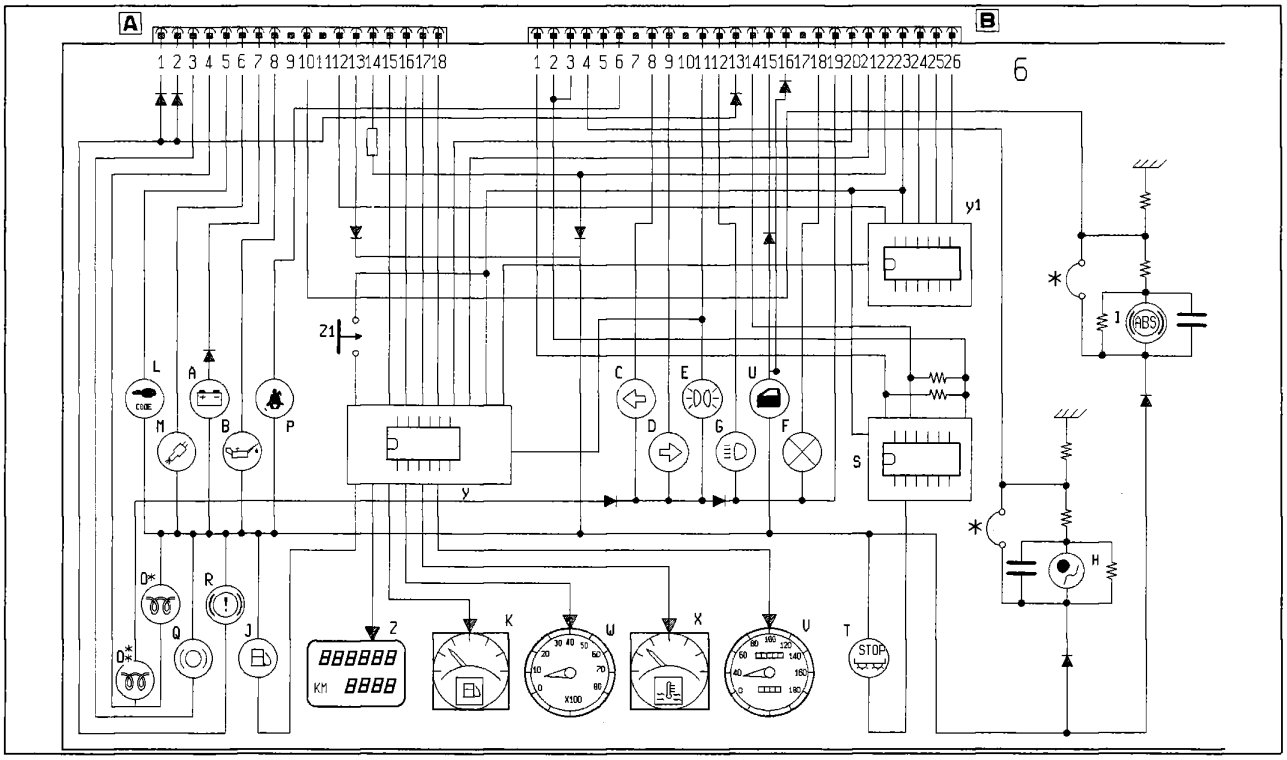
**NOTE** *The previous control panel configuration is still used for the 1581 version with automatic transmission*



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# 55.

Wiring diagram




(*) JTD

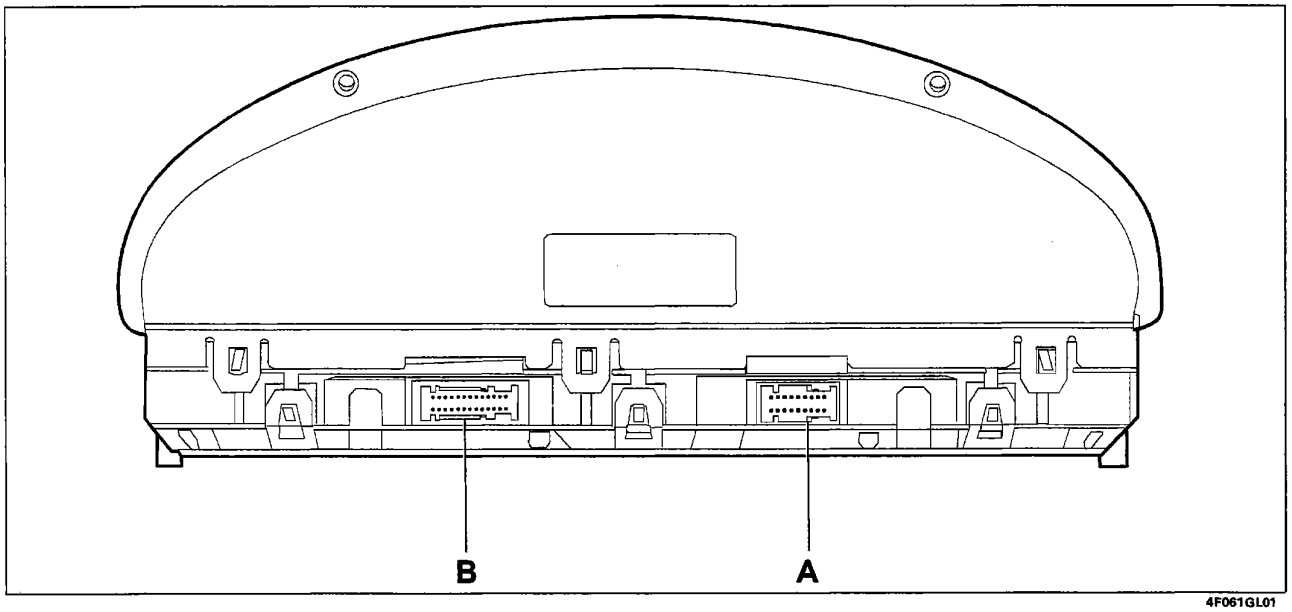
(**) TD 75 BHP

A. Battery recharging warning light
B. Low engine oil pressure warning light
C. Left direction indicator warning light
D. Right direction indicator warning light
E. Side lights warning light
F. Instrument panel symbol lighting
G. Main beam warning light
H. Air Bag fault warning light
I. ABS failure warning light
J. Fuel reserve warning light
K. Fuel level gauge
L. FIAT CODE system warning light
M. Injection system failure warning light
O. Glow plug warning light
P. Seat belt warning light
Q. Brake pad wear warning light
R. Low brake fluid/handbrake on/EBD system failure warning light
S. Brake light electronic control module
T. Brake light failure warning light
U. Doors open warning ilght
V. Speedometer
W. Rev counter
X. Engine coolant temperature gauge
Y. Electronic module
Y1 Speed control module
Z. Mileometer - trip counter/outdoor temperature gauge
Z1 Odometer reset button
Z2 Odometer lighting

* Short-circuit plugs

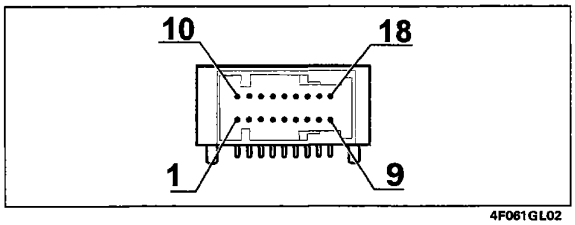



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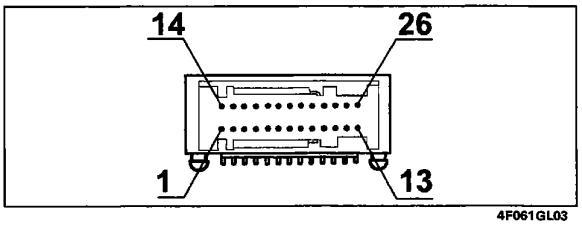


4F061GL01

**Rear side (the connector sockets are shown)**



4F061GL02



4F061GL03

**Connector A (on front lead)**

| Pin no. | Cable colour | Circuit involved |
|---|---|---|
| 1 | BV | EBD system failure |
| 2 | BN | Brake fluid level |
| 3 | BR | Brake pad wear |
| 4 | CL | Glow plug preheating (only for TD and JTD versions) |
| 5 | MN | FIAT CODE |
| 6 | LN | Injection system fault |
| 7 | HN | Battery recharging |
| 8 | HG | Engine oil minimum pressure |
| 9 | - | Engine oil level (*) |
| 10 | RV | ABS fault |
| 11 | - | N.C. |
| 12 | VB | Speedometer signal |
| 13 | AG | +30 battery |
| 14 | CN | Speedometer generator power supply |
| 15 | HB | Engine coolant temperature |
| 16 | HL | Outdoor temperature signal |
| 17 | HM | Speedometer signal |
| 18 | L | Rev counter signal |

(*) not connected in this version

**Connector B (on facia lead)**

| Pin no. | Wiring colours | Circuit |
|---|---|---|
| 1 | RG | Left brake light failure |
| 2 | RV | Brake light switch |
| 3 | RV | Brake light switch |
| 4 | C | Air Bag system fault |
| 5 | - | Passenger air bag off (*) |
| 6 | M | Seat belt |
| 7 | - | N.C. |
| 8 | A | Left turn signal |
| 9 | AN | Right turn signal |
| 10 | - | N.C. |
| 11 | GN | Side lights |
| 12 | LB | Main beam headlamps |
| 13 | BN | Handbrake on |
| 14 | RN | Right brake light failure |
| 15 | H | Doors open |
| 16 | CN | Boot open |
| 17 | - | N.C. |
| 18 | GR | Instrument panel light |
| 19 | N | Lighting earth |
| 20 | HG | Fuel level |
| 21 | GL | Outdoor temperature display |
| 22 | R | +15 from ignition |
| 23 | N | electronic earth |
| 24 | - | speedometer signal (*) |
| 25 | VN | Speedometer signal |
| 26 | - | speedometer signal (*) |

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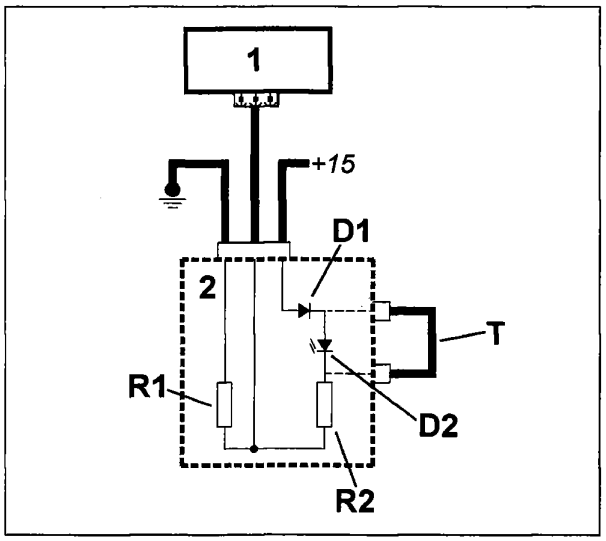

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# 55.

### SMART WARNING LIGHTS

For the "Air Bag" and "ABS" functions, the ordinary warning lights have been replaced by an electronic circuit which performs a **SMART WARNING LIGHT** function.

- the indicator comes on upon a signal from the control unit, which produces a fault or alarm signal;
- the indicator comes on even when a mis-connection or short-circuit to earth is detected between control unit and panel. This function is carried out by the small circuit shown in the figure. The warning light is led D2 and it comes on when an earth signal is received from control unit (1) or if the connection is broken or s.c. to earth.




D1: protection diode
D2: *warning light*
**R1, R2**: *charging resistances*
1: *control unit*
2: *circuit built into warning light*

On some outfits, the ABS and Air Bag systems are suppied as options. If these systems are NOT fitted to the car, the built-in circuit will indicate a continuous fault because it is not connected to a control unit.
Parallel to led D2 are fitted bulb socket (A) for the ABS system and bulb socket (B) for the Air Bag system:
- if these systems are present, a white plug is fitted to these sockets and the circuit works normally;
- if one of the two systems is NOT present, the plug is replaced by a bridge (T) that short-circuits the warning light.

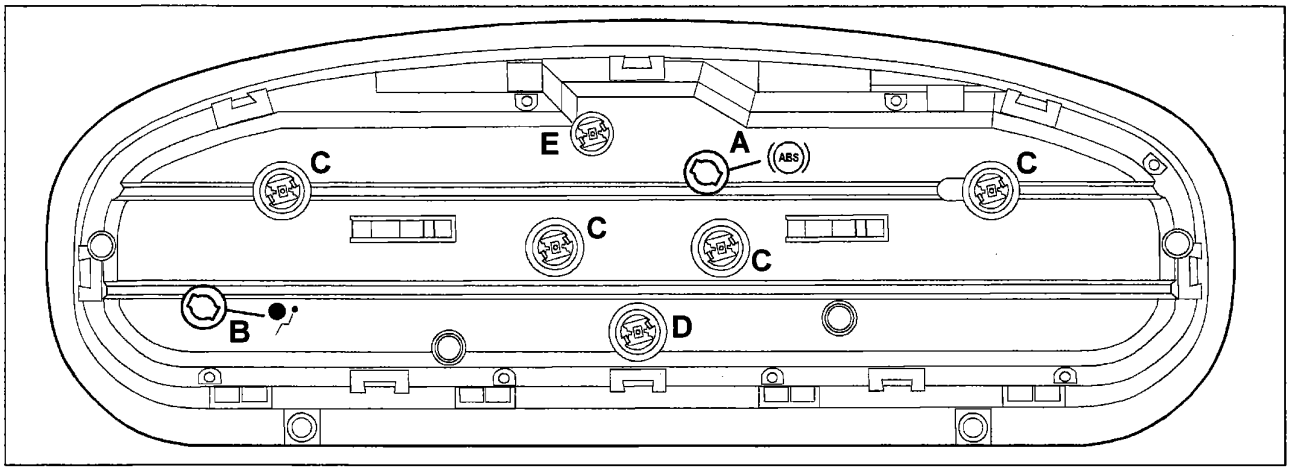
### CHANGING BULBS

The control panel consists of a single built-in component supplied as one part.
It is nevertheless possible to replace some warning light bulbs via their bulb holders. These come in three types:
- holders indicated by (**C**) - red, 2 W - these light the control panel;
- holders indicated by (D) - black, 1.2 W - these refer to the odometer display lighting ;
- holders indicated by (E) - allow replacement of the main beam warning light bulb



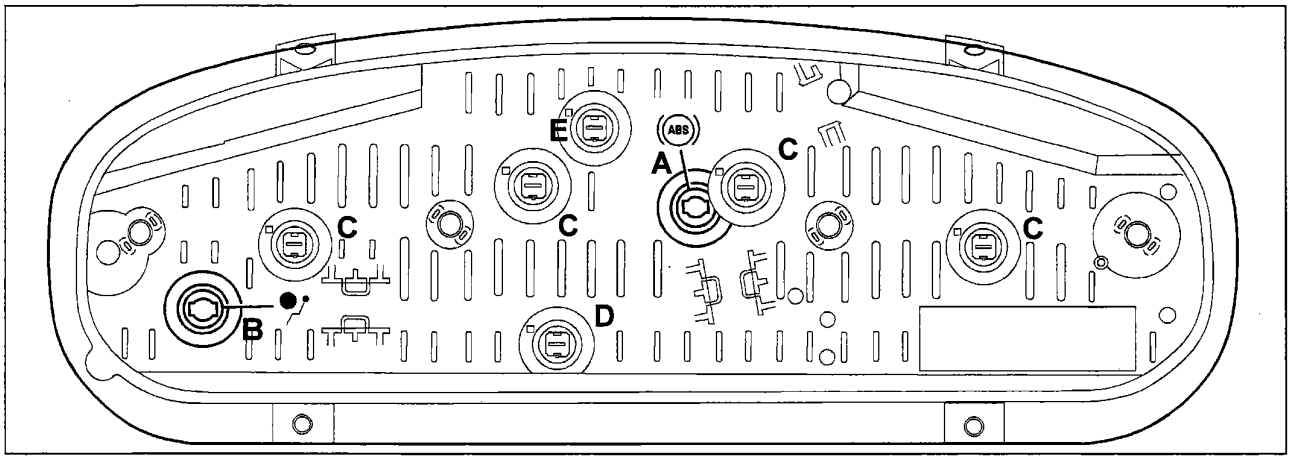

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Location of caps and replaceable bulbs on instrument panel (Supplier VEGLIA BORLETTI)




4F063GL01

Location of caps and replaceable bulbs on instrument panel (Supplier N.S.I.)




4F063GL02

A. cap/bridge for ABS
B. cap/bridge for Air Bag
C. Panel light bulbs
D. Odometer display light bulb
E. Main beam warning light bulb

*Total mileage reset*

Total mileage may be reset to zero - within the first 200 km - following transfer in the factory or before hand-over to the customer.
If the instrument is new, the mileage reading is preceded by an "H" (e.g. H00199"). After 200 km, the letter H disappears automatically and the reading becomes "000201".
If the zero reset key is pressed for longer than three seconds before the first 200 km, the letter H disappears and the counter is reset to "000000" This operation can be carried out once only!



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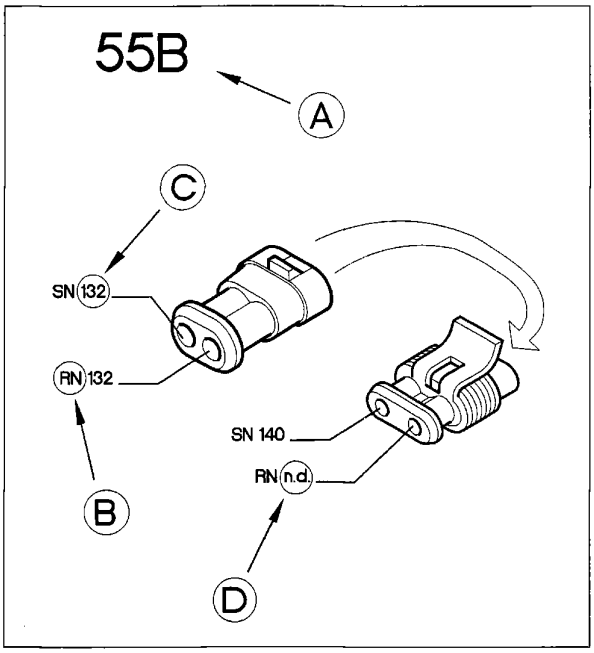
page

- Meaning of codes on connector blocks 116
- Cable colour code 116
- Connector blocks 117



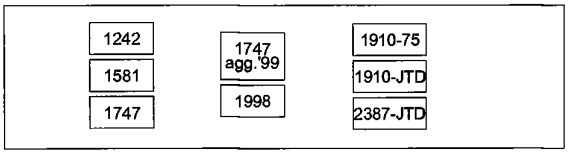
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# 55.




**A** Identification N° of connector block with reference to the wiring diagrams.
**B** Cable colour code identification number (see table at foot of page).
**C** Identification N° of designated connector block for cable marked with relevant code.
**D** The code "n.d." denotes a connector block taped in the cable loom

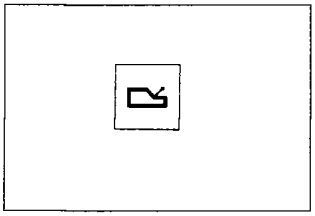
*Engine type identification*

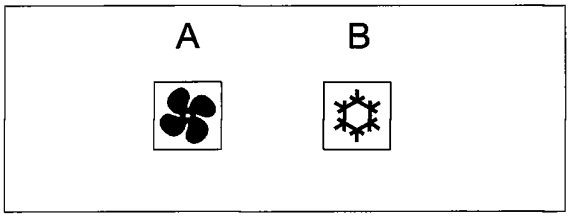



*Climate control type identification*

*A automatic heater*
*B automatic air conditioning*

*Versions with Automatic transmission*






**ATTENTION All connector blocks are depicted from the lead input side.**

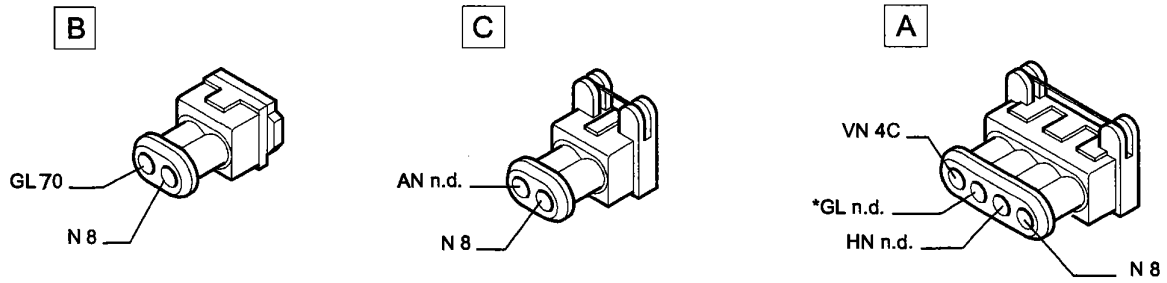
**Cable colour code**

| | | | | | |
|---|---|---|---|---|---|
| **A** | Light blue | **BG** | White-Yellow | **LB** | Dark blue-White |
| **B** | White | **BL** | White-Dark blue | **LG** | Dark blue-Yellow |
| **C** | Orange | **BN** | White-Black | **LN** | Dark blue-Black |
| **G** | Yellow | **BR** | White-Red | **LR** | Dark blue-Red |
| **H** | Grey | **BV** | White-Green | **LV** | Dark blue-Green |
| **L** | Dark blue | **BZ** | White-Purple | **MB** | Brown-White |
| **M** | Brown | **CA** | Orange-Light blue | **MN** | Brown-Black |
| **N** | Black | **CB** | Orange-White | **NZ** | Black-Purple |
| **R** | Red | **CN** | Orange-Black | **RB** | Red-White |
| **S** | Pink | **GN** | Yellow-Black | **RG** | Red-Yellow |
| **V** | Green | **GL** | Yellow-Dark blue | **RN** | Red-Black |
| **Z** | Purple | **GR** | Yellow-Red | **RV** | Red-Green |
| **AB** | Light blue-White | **GV** | Yellow-Green | **SN** | Pink-Black |
| **AG** | Light blue-Yellow | **HG** | Grey-Yellow | **VB** | Green-White |
| **AN** | Light blue-Black | **HN** | Grey-Black | **VN** | Green-Black |
| **AR** | Light blue-Red | **HR** | Grey-Red | **VR** | Green-Red |
| **AV** | Light blue-Green | **HV** | Grey-Green | **ZB** | Purple-White |




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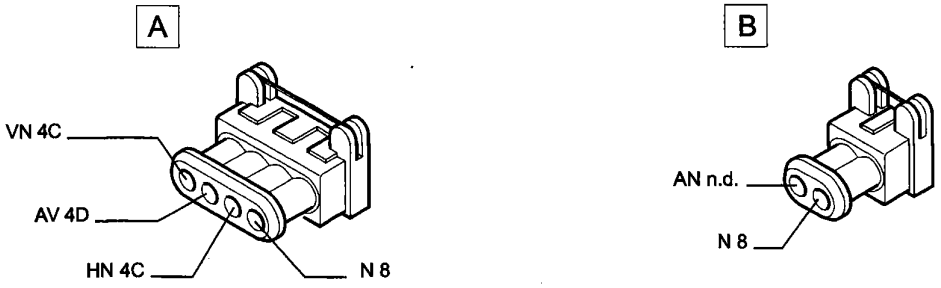
**1** Left front light cluster




Polyelliptical headlamps (*) wire not connected

P4F917N01

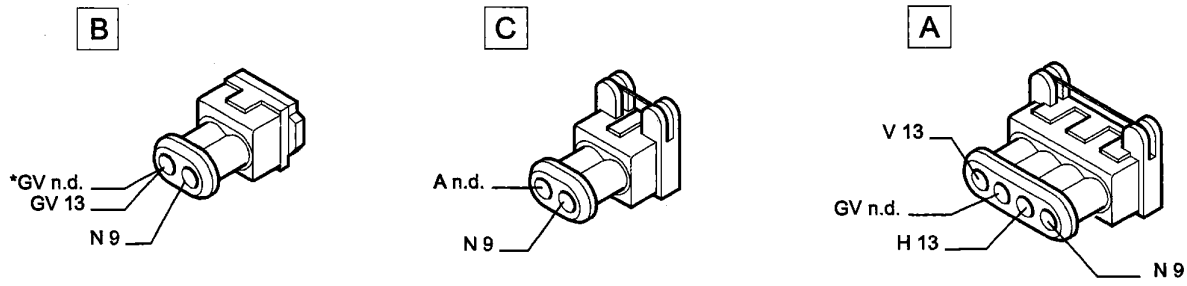
**1** Left front light cluster




Reflector headlamps

P4F917N02

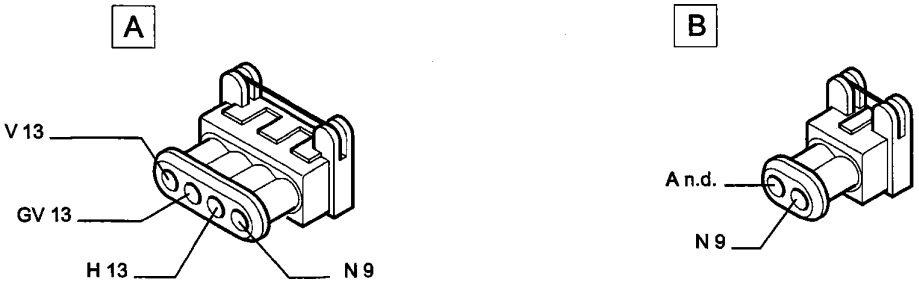
**2** Right front light cluster




Polyelliptical headlamps (*) with Check Panel

P4F917N03

**2** Right front light cluster



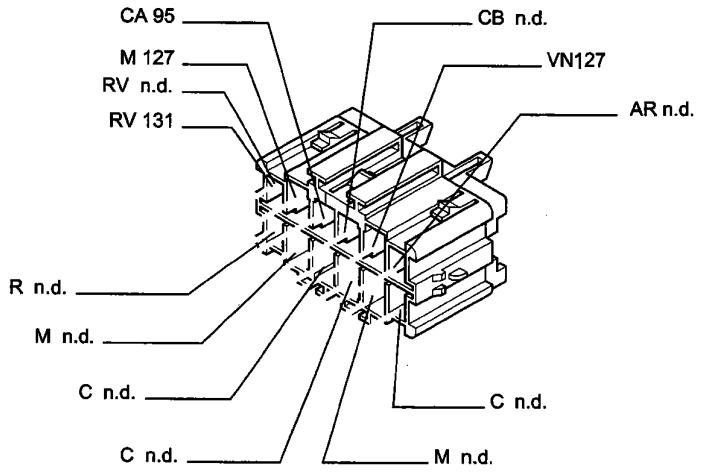

P4F917N04



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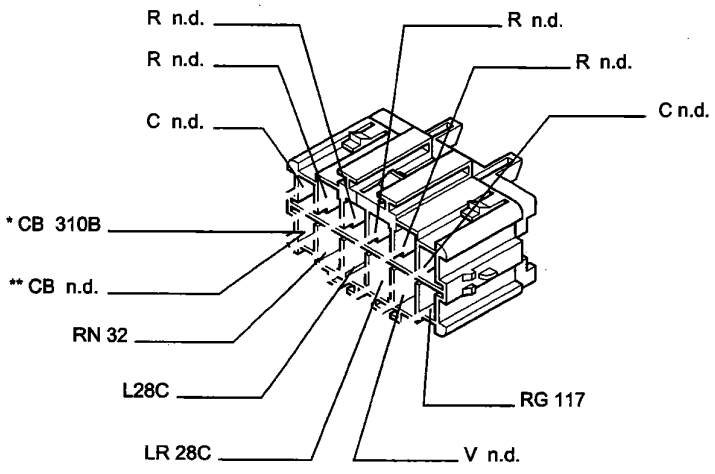
## 55.

### 3A Power fusebox




P4F918N01

### 3D Power fusebox




(*) from Nov. '99

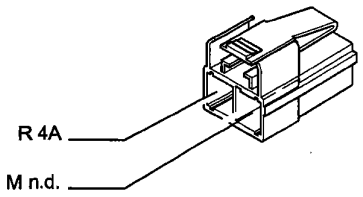
(**) up to Nov. '99

P4F918N03



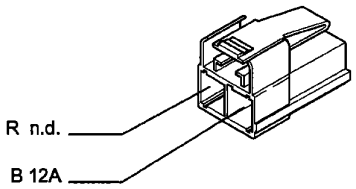

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## 3B Power fusebox



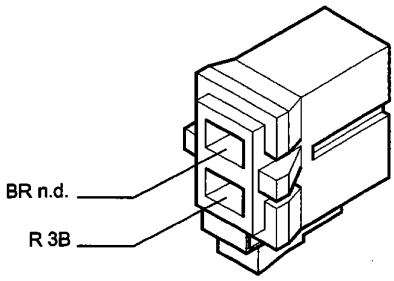

P4F919N09

## 3C Power fusebox



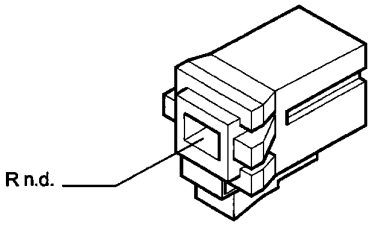

P4F919N02

## 4A Junction unit



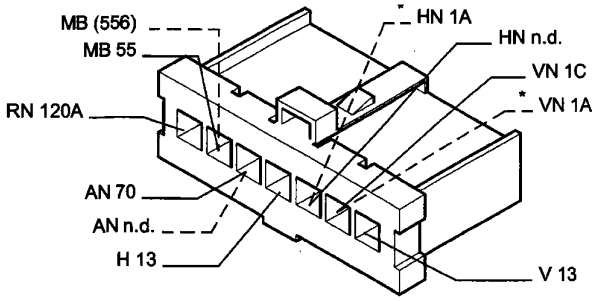

P4F919N10

## 4B Junction unit




P4F919N04

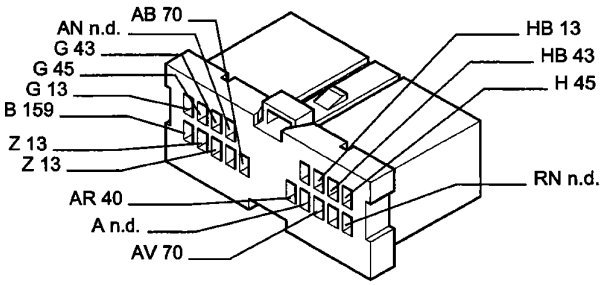
## 4C Junction unit




* Reflector headlamps

P4F919N05

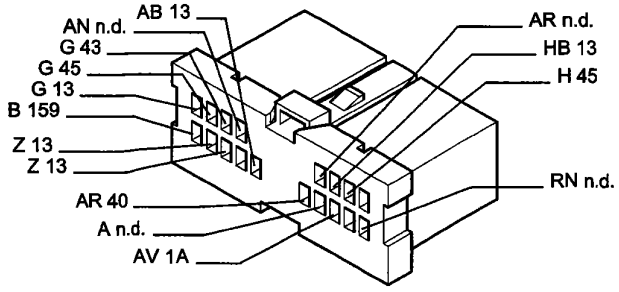
## 4C Junction unit




With Check Panel

P4F919N06

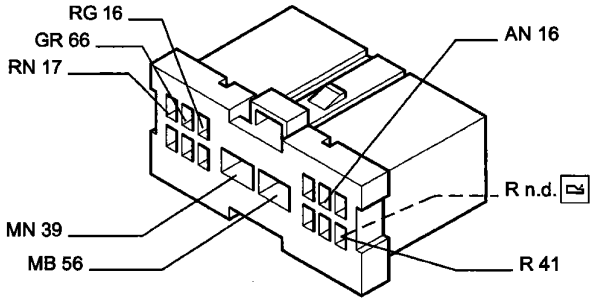
## 4D Junction unit




Without Check Panel

P4F919N07

## 4E Junction unit




Marea, with Check Panel

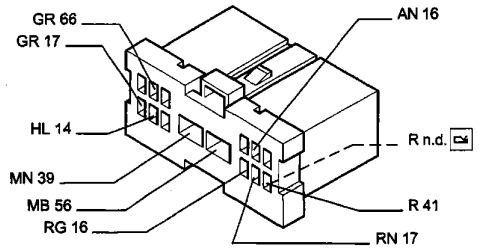
P4F919N08



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# 55.

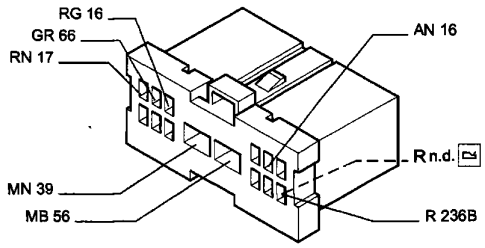
**4E** Junction unit




Marea, without Check Panel

P4F920N01

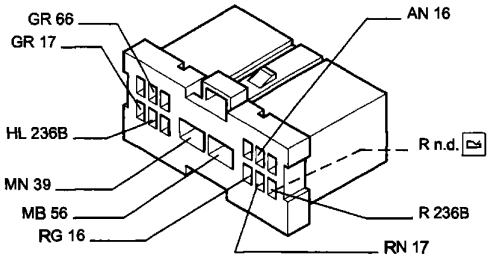
**4E** Junction unit




Marea Weekend, with Check Panel

P4F920N02

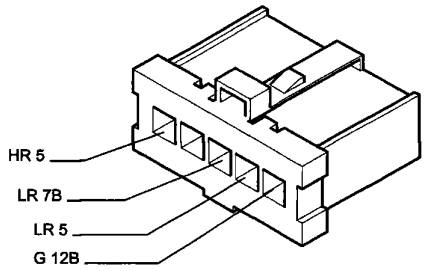
**4E** Junction unit




Marea Weekend, without Check Panel

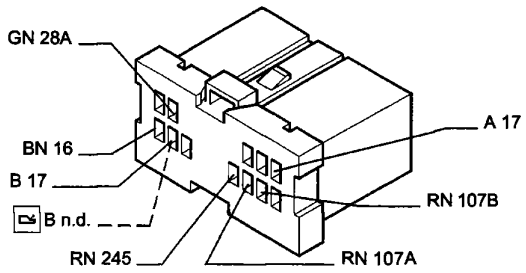
P4F920N03

**4F** Junction unit




P4F920N04

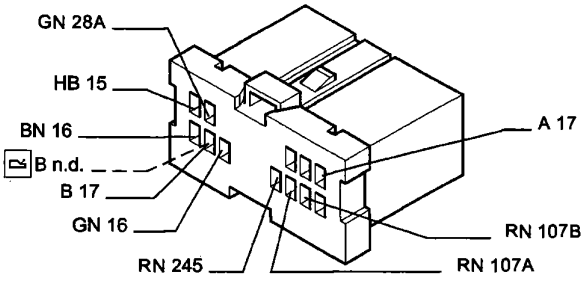
**4G** Junction unit




Marea, with Check Panel

P4F920N05

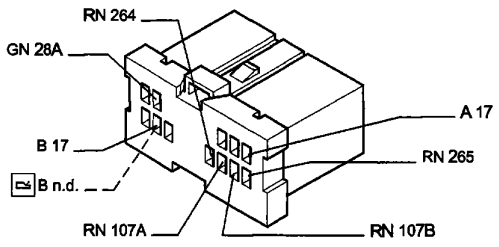
**4G** Junction unit




Marea, without Check Panel

P4F920N06

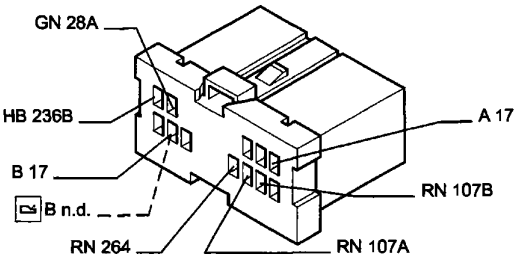
**4G** Junction unit




Marea Weekend, with Check Panel

P4F920N07

**4G** Junction unit



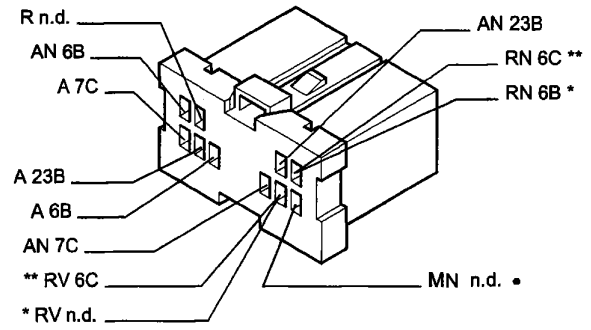

Marea Weekend, without Check Panel

P4F920N08




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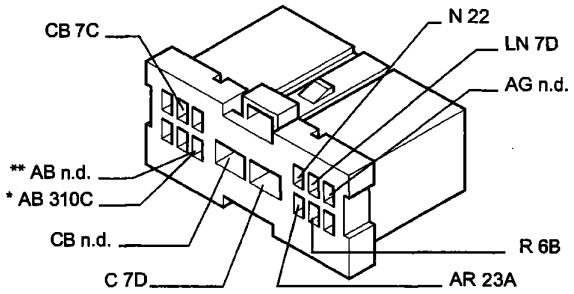
## 4H Junction unit




• Thermal fuse

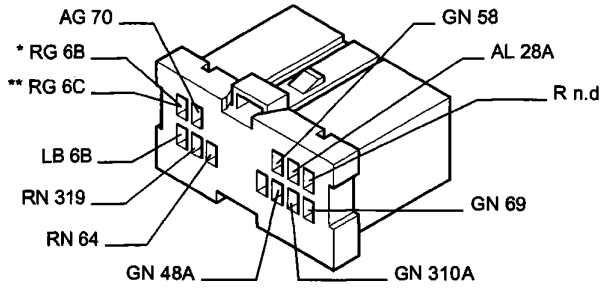
P4F921N09

## 4I Junction unit



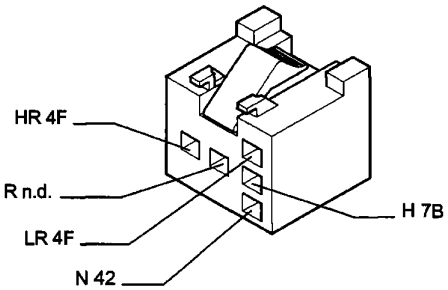

P4F921N10

## 4J Junction unit



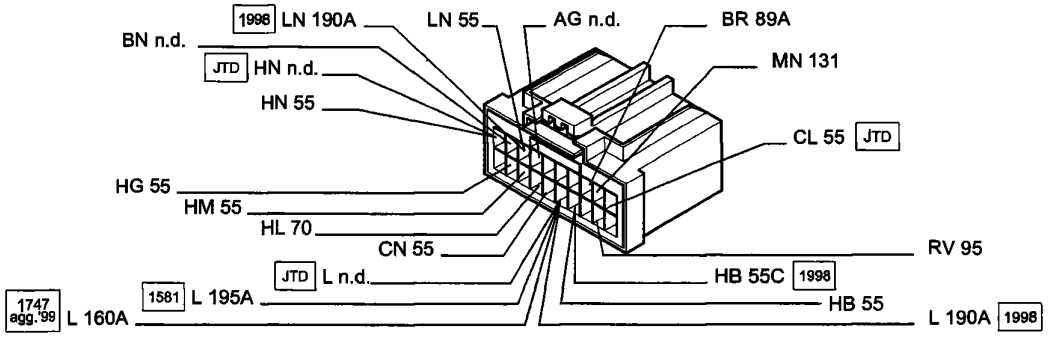

P4F921N11

## 5 Dipped headlamps relay feed



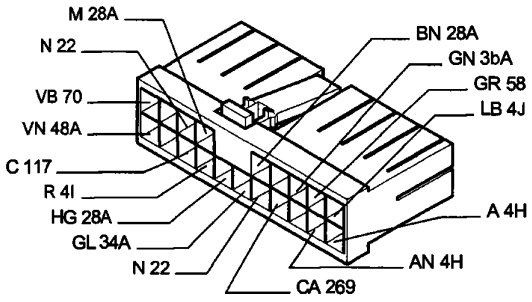

P4F921N04

## 6A Instrument panel (**)



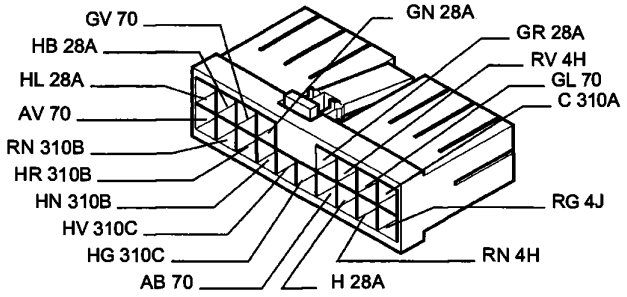

P4F921N05

## 6B Instrument panel (**)




P4F921N06

## 6C Instrument panel (**)




With Check Panel

P4F921N07

(*) from Nov. 99

(**) up to Nov. 99

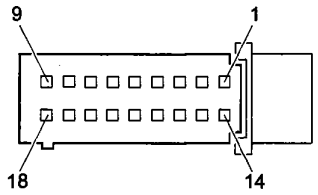


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# 55.

## 6A Instrument panel (*)

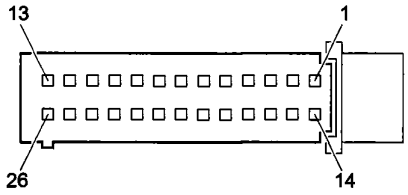
| | | |
|---|---|---|
| 1 | BV 95 | |
| 2 | BN 88 | |
| 3 | BR 89A | |
| 4 | CL 55 | 1910-75 |
| 4 | CL 55A | JTD |
| 5 | MN 131B | |
| 6 | LN 190A | 1998 |
| 6 | LN 140A | 1242 |
| 6 | LN 195A | 1581 |
| 6 | LN 160A | 1747 |
| 6 | LN 55A | JTD |
| 7 | HN 55 | |
| 7 | HN n.d. | JTD |
| 8 | HG 55 | |
| 10 | RV 95 | |
| 12 | VB 190A | 1998 |
| 12 | VB 55A | JTD |
| 12 | VB 160A | 1747 |
| 12 | VB 195A | 1581 |
| 12 | VB 140A | 1242 |
| 13 | AG n.d. | |
| 14 | CN 55 | |
| 15 | HB 55 | |
| 16 | HL 70 | |
| 17 | HM 55 | |
| 17 | L n.d. | JTD |
| 18 | L 190A | 1998 |
| 18 | L 160A | 1747 |
| 18 | L 195A | 1581 |
| 18 | L 140A | 1242 |




P4F920N04

## 6B Instrument panel (*)

| | |
|---|---|
| 1 | RG 4J |
| 2 | RV n.d. |
| 3 | RV n.d. |
| 4 | C 117 |
| 6 | M 28A |
| 8 | A 4H |
| 9 | AN 4H |
| 11 | GN 310A |
| 12 | LB 4J |
| 13 | BN 28A |
| 14 | RN 4H |
| 15 | H 70 • |
| 15 | H 310C •• |
| 16 | CN 310A |
| 18 | GR 58 |
| 19 | N 22 |
| 20 | HG 28A |
| 21 | GL 34A |
| 22 | R 4I |
| 23 | N 22 |
| 25 | VN 48A |



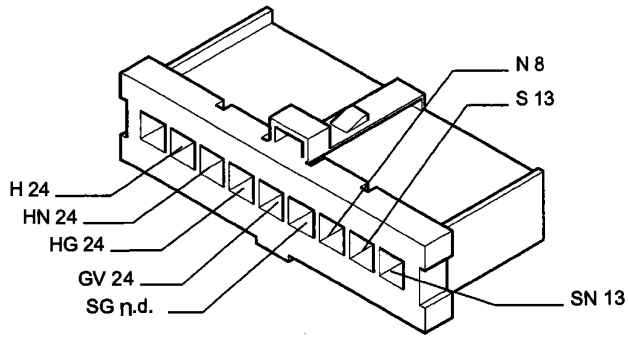

4F999N02

(*) from Nov. 99

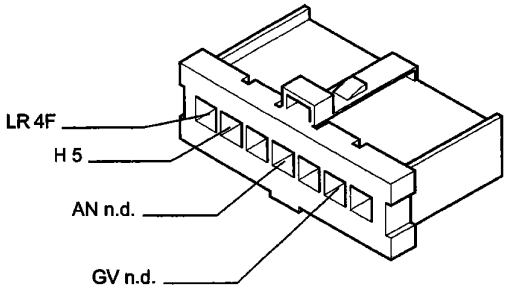



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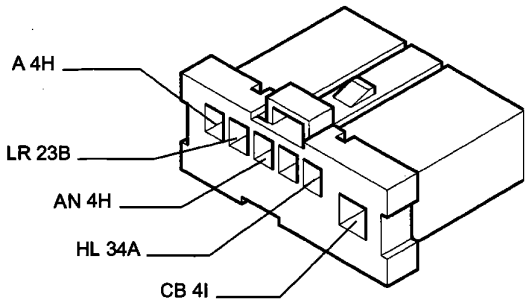
## 7A Steering column switch unit



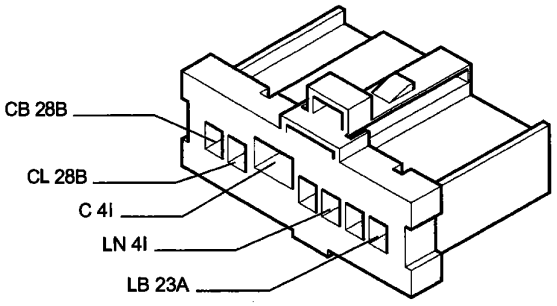

## 7B Steering column switch unit



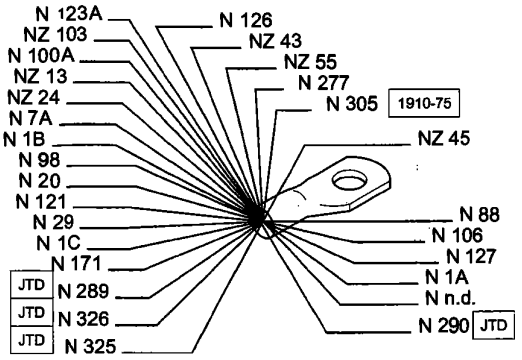

## 7C Steering column switch unit



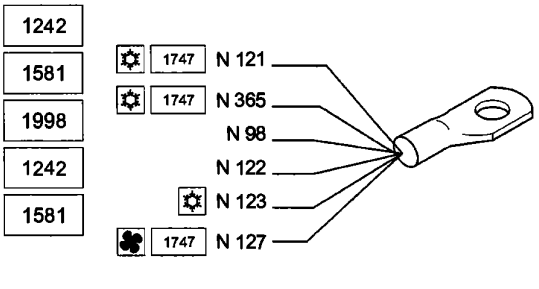

## 7D Steering column switch unit




## 8 Left front earth

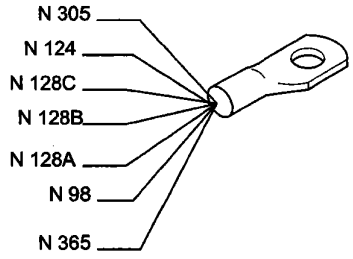



## 8A Left front earth



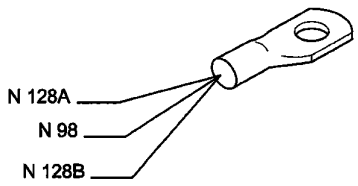

## 8A Left front earth

1910-75




## 8A Left front earth

2387-JTD



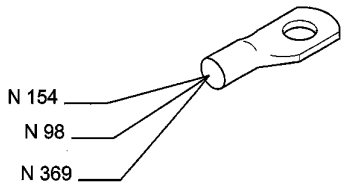



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## 8A Left front earth

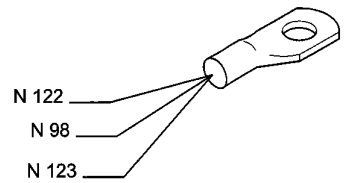
1910-JTD




P4F923N01

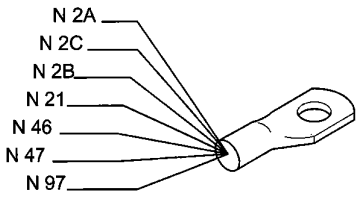
## 8A Left front earth

1910-JTD



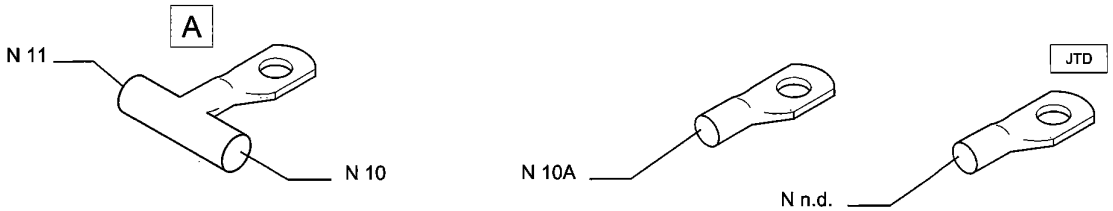

P4F923N02

## 9 Right front earth



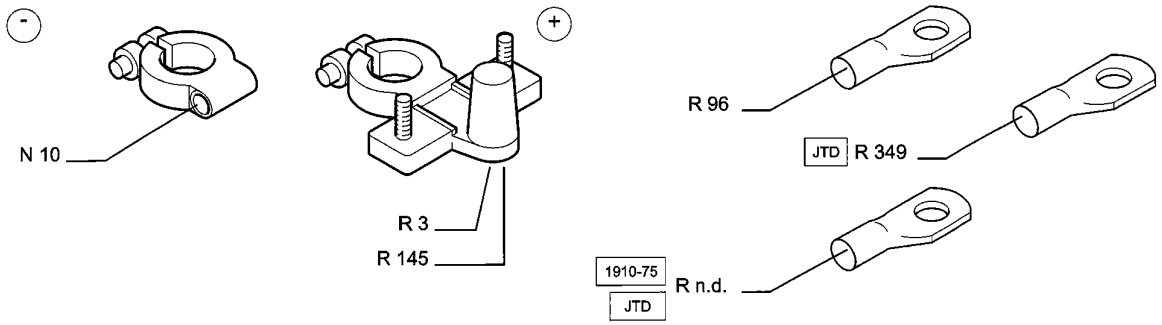

P4F923N03

## 10 Battery earth on engine




P4F923N04

## 11 Battery



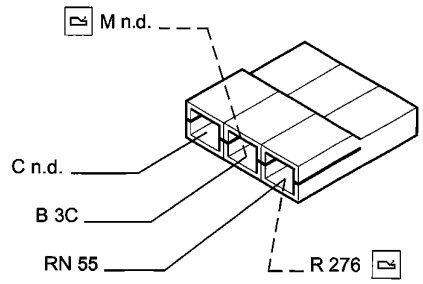

P4F923N05



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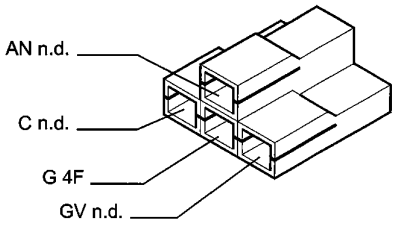
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## 12A Ignition switch



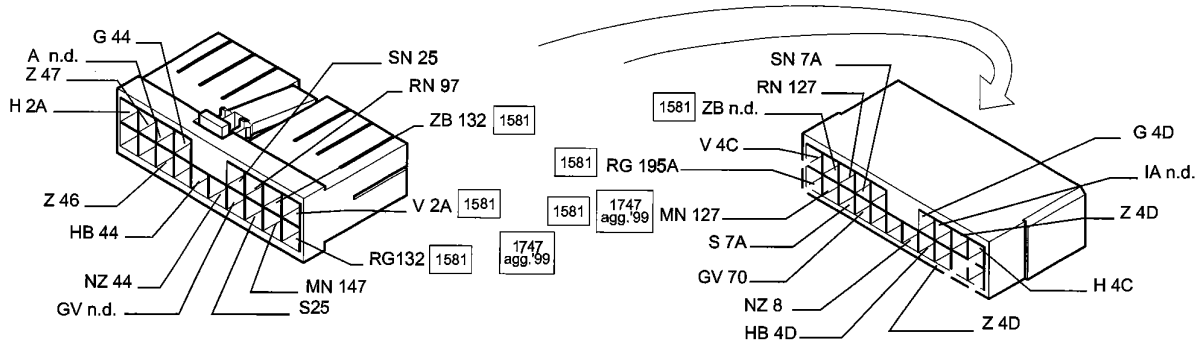

P4F924N01

## 12B Ignition switch



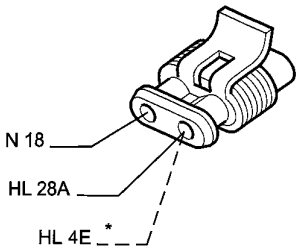

P4F924N02

## 13 Connection between right/left front cables




P4F924N03

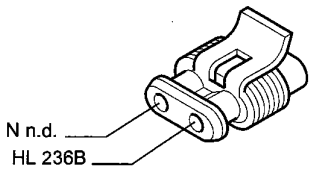
## 14 Left no. plate light




Marea * Without Check Panel

P4F924N04

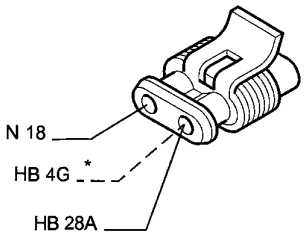
## 14 Left no. plate light




Marea Weekend

P4F924N05

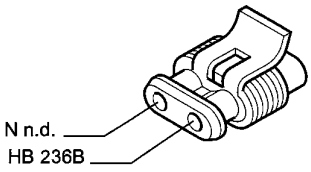
## 15 Right no. plate light




Marea * Without Check Panel

P4F924N06

## 15 Right no. plate light



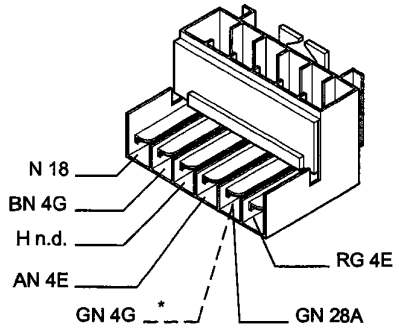

Marea Weekend

P4F924N07




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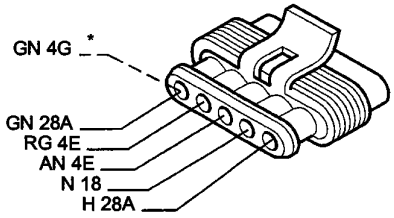
## 16 Left rear light cluster




Marea * Without Check Panel

P4F925N01

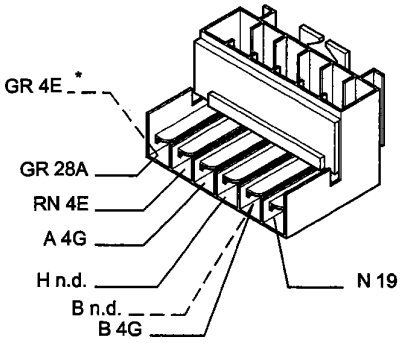
## 16 Left rear light cluster




Marea Weekend * Without Check Panel

P4F925N02

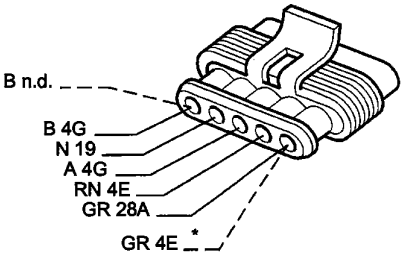
## 17 Right rear light cluster




Marea * Without Check Panel

P4F925N03

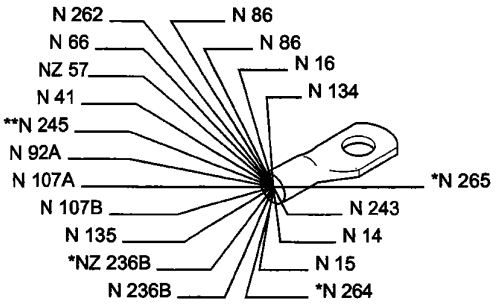
## 17 Right rear light cluster




Marea Weekend * Without Check Panel

P4F925N04

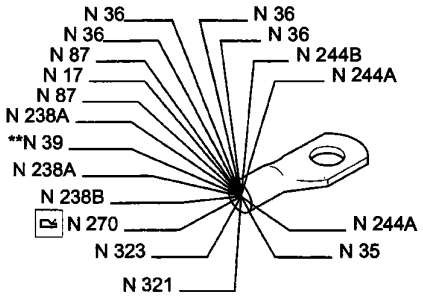
## 18 Left rear earth




** Marea * Marea Weekend

P4F925N05

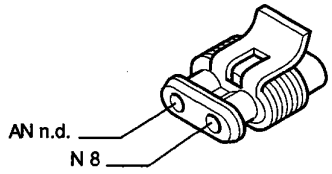
## 19 Right rear earth




** Marea * Marea Weekend

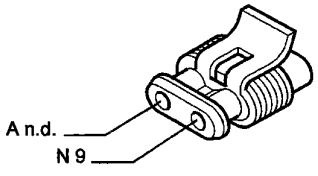
P4F925N06

## 20 Left front side direction indicator




P4F925N07

## 21 Right front side direction indicator



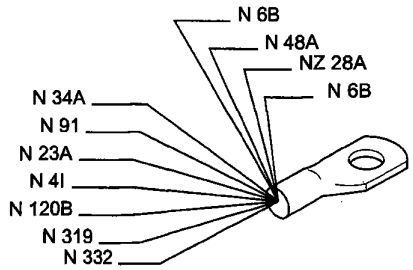

P4F925N08



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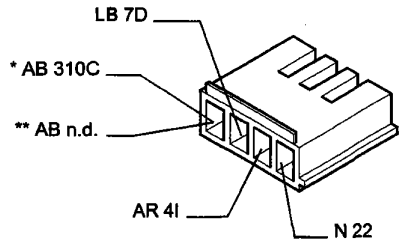
# 55.

## 22 Left facia earth



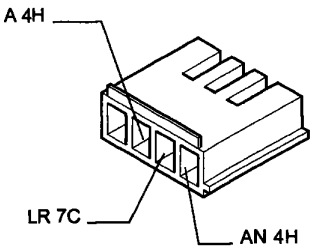

P4F926N01

## 23A Hazard warning lights switch unit



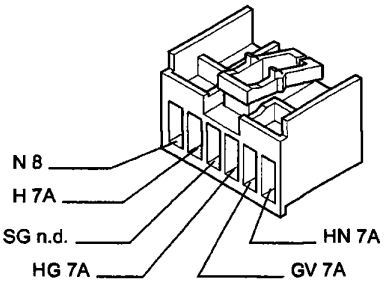

P4F926N08

## 23B Hazard warning lights switch unit



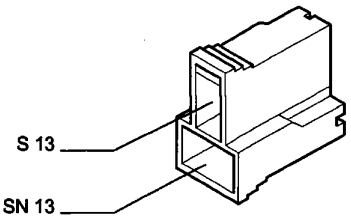

P4F926N03

## 24 Windscreen wiper motor



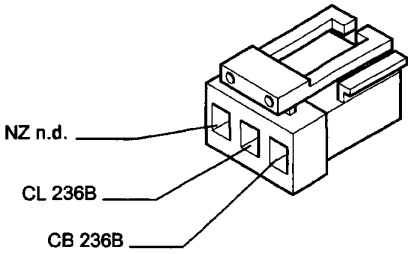

P4F926N04

## 25 Electric windscreen/rearscreen washer pump



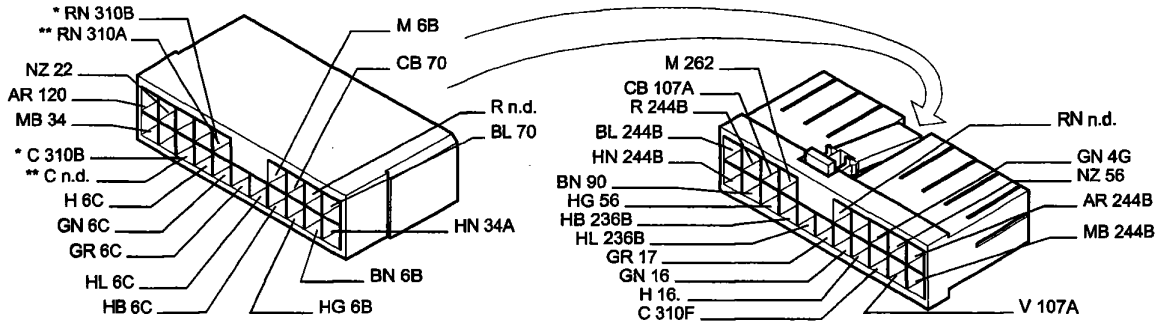

P4F926N05

## 26 Windscreen wiper motor




P4F926N06

## 28A Facia/rear lead connection




Marea, with Check Panel

P4F926N09

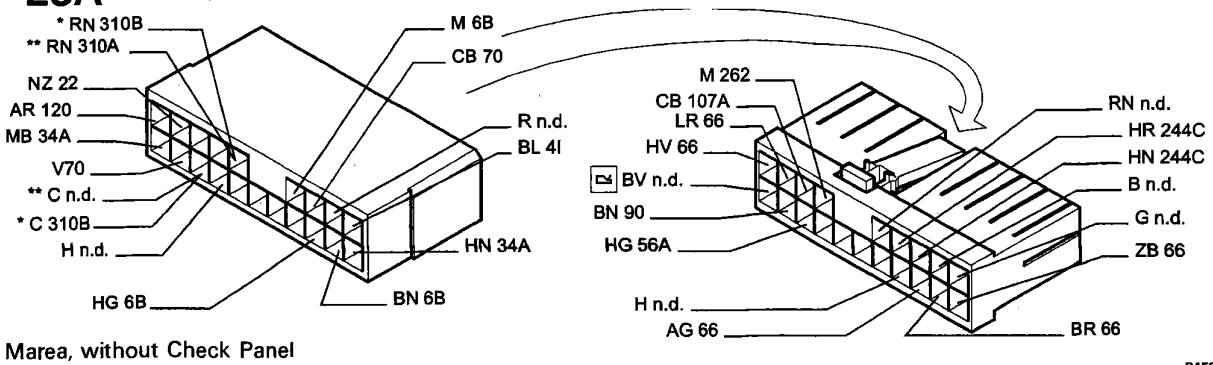
(*) from Nov. 99

(**) up to Nov. 99




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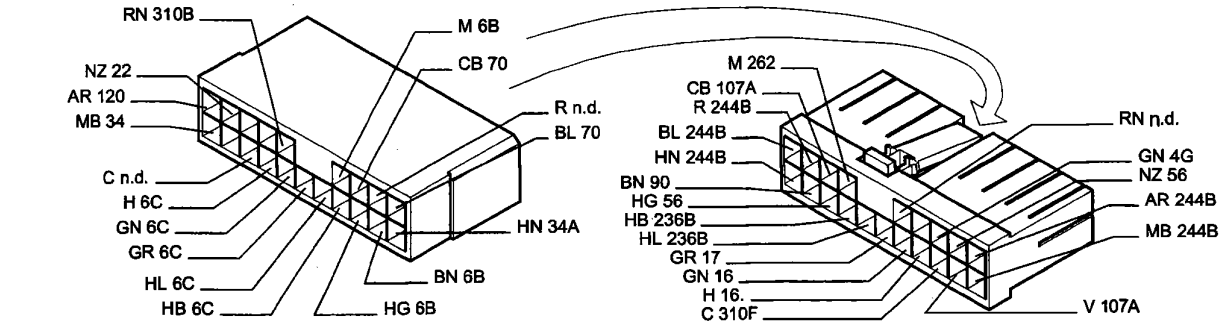
## 28A Facia/rear lead connection




Marea, without Check Panel

P4F927N05

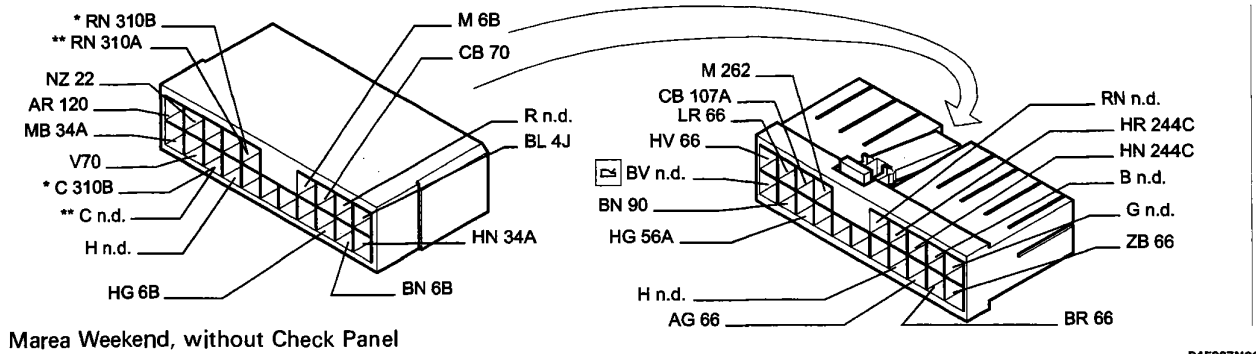
## 28A Facia/rear lead connection




Marea Weekend, with Check Panel

P4F927N02

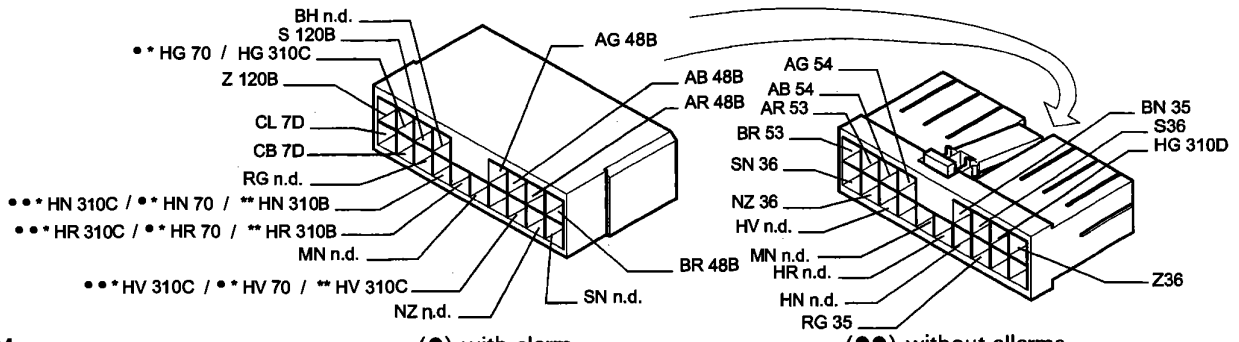
## 28A Facia/rear lead connection




Marea Weekend, without Check Panel

P4F927N06

## 28B Facia/rear lead connection




Marea

(●) with alarm

(●●) without allarme

P4F927N07

(*) from Nov. 99

(**) up to Nov. 99



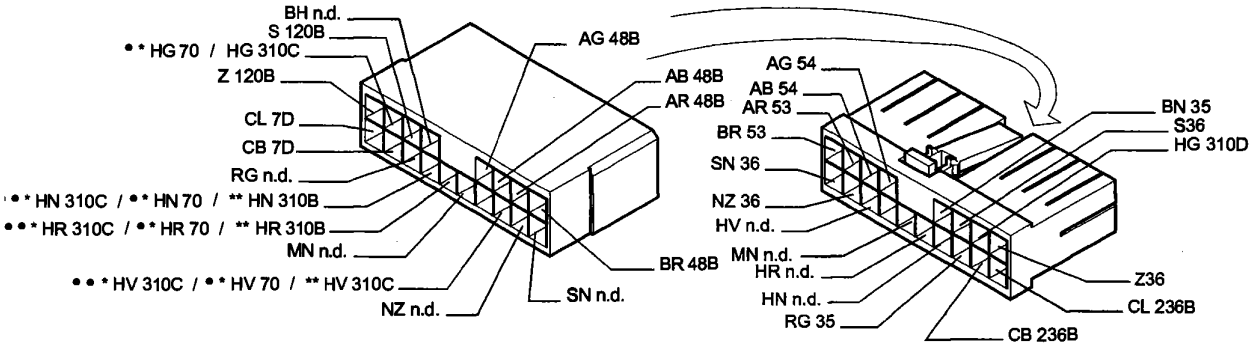
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# 55.

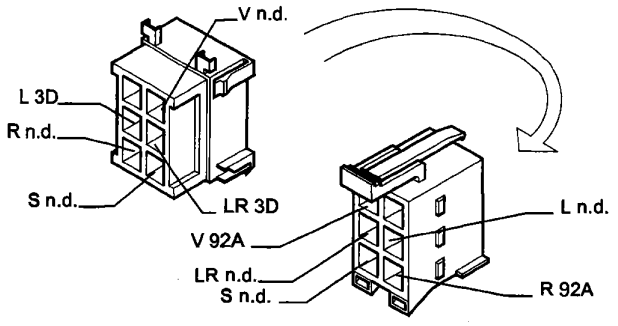
## 28B Facia/rear lead connection




Marea Weekend (●) with alarm (●●) without alarm

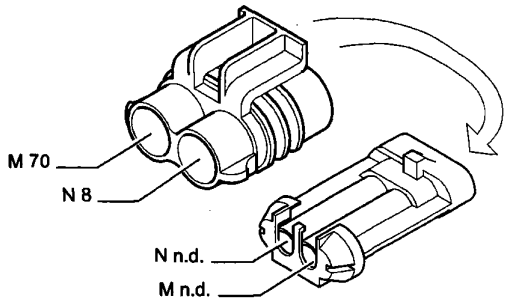
P4F928N08

## 28C Facia/rear lead connection



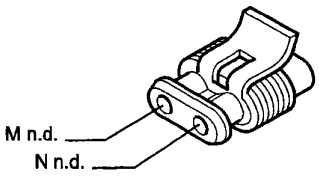

P4F928N02

## 29 Front/fog lamp lead connection



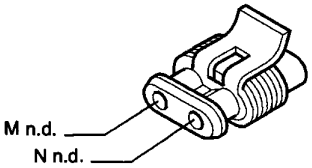

P4F928N03

## 30 Left fog light



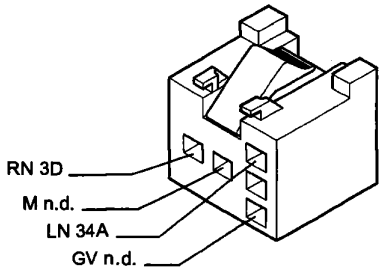

P4F928N04

## 31 Right fog light



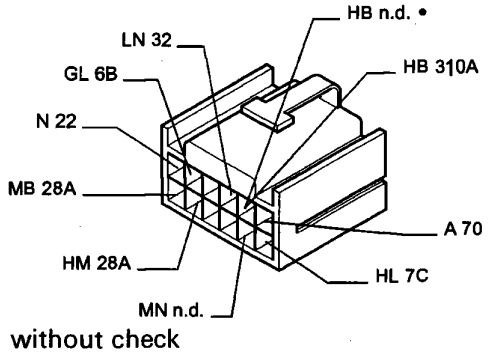

P4F928N05

## 32 Fog lamp control relay




P4F928N06

## 34A Switch control panel




(●) without check

P4F928N09

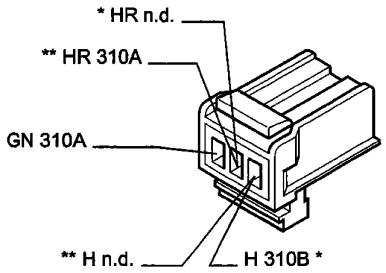
(*) from Nov. 99

(**) up to Nov. 99



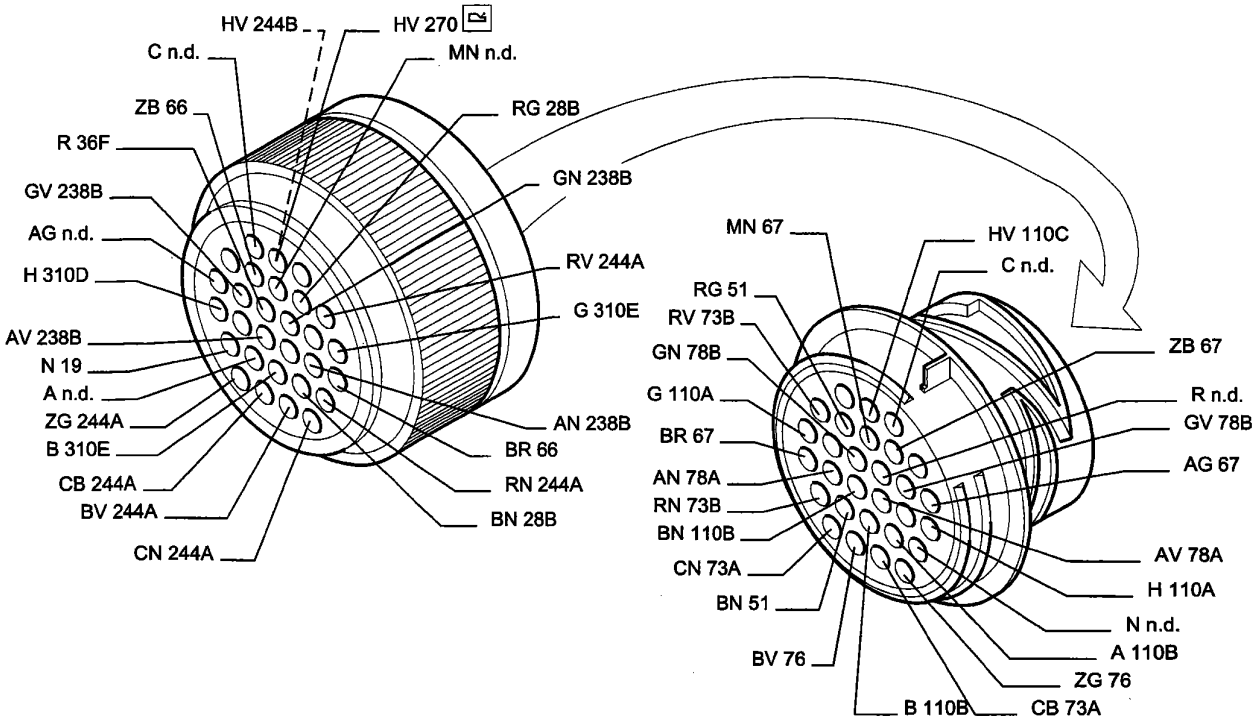

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## 34B Switch control panel




P4F929N03

## 35 Connection between dashboard/left front door cables




P4F929N02

(*) from Nov. 99

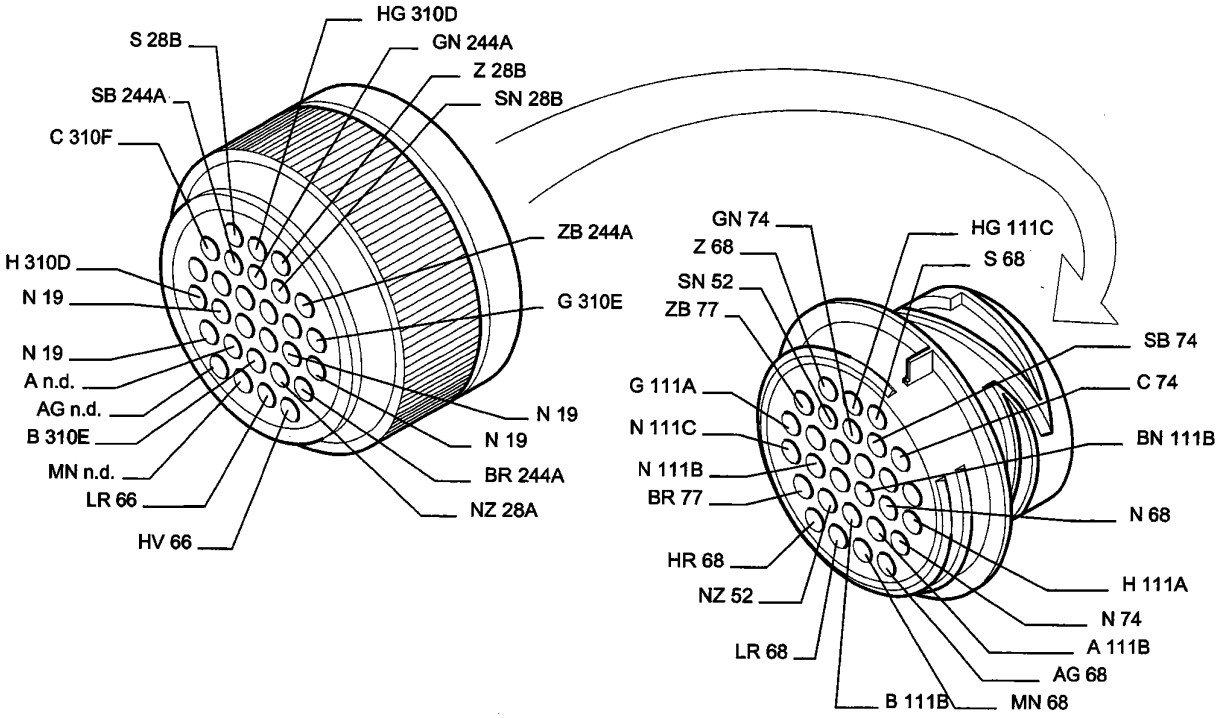
(**) up to Nov. 99



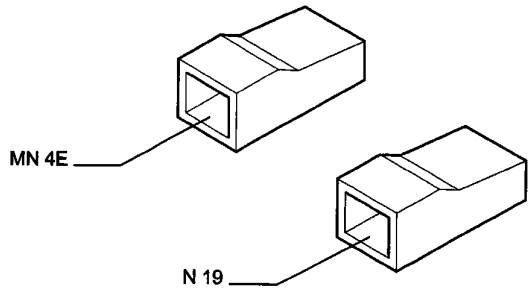
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# 55.

## 36 Connection between dashboard/right front door cables

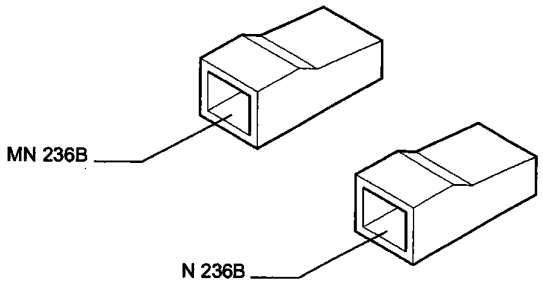



## 39 Heated rear windscreen



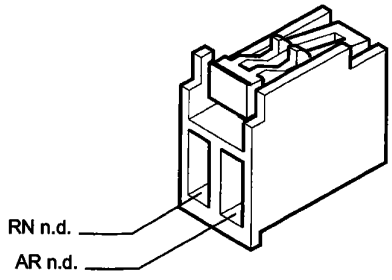

Marea

## 39 Heated rear windscreen

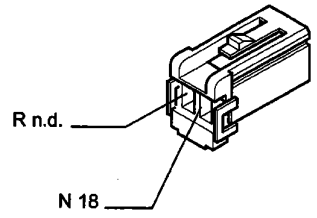



Marea Weekend

## 40 Brake lights control switch




## 41 Additional brake light

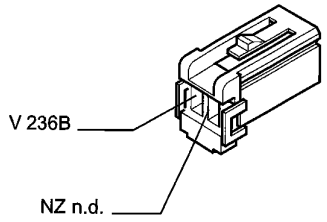



Marea




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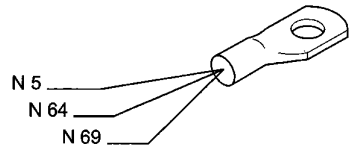
**41** Additional brake light




Marea Weekend

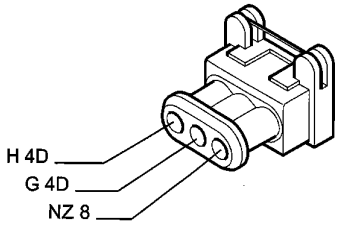
P4F931N01

**42** Right dashboard earth



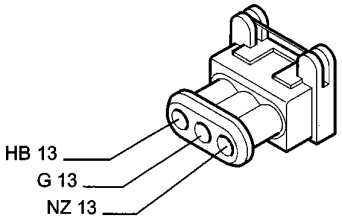

P4F931N02

**43** Electrical actuator for left headlamp alignment



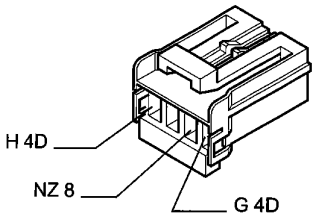

P4F931N03

**44** Electrical actuator for right headlamp alignment



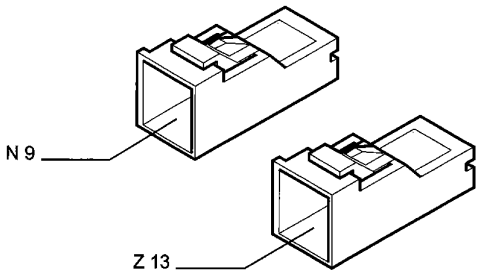

P4F931N04

**45** Headlamp alignment control unit



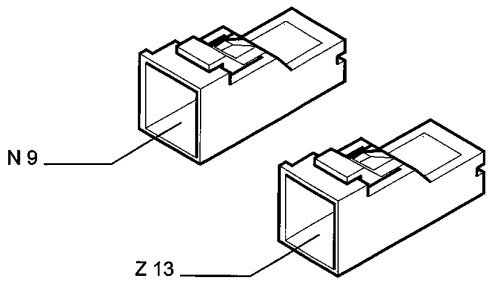

P4F931N05

**46** Left low tone horn



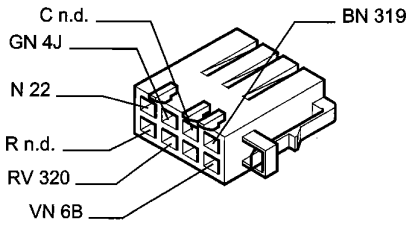

P4F931N06

**47** Right high tone horn




P4F931N07

**48A** Radio receiver with clock



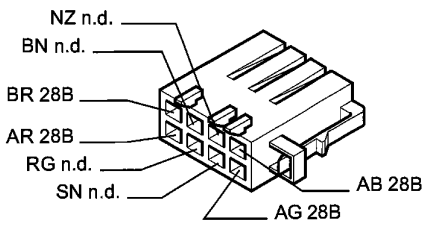

P4F931N08



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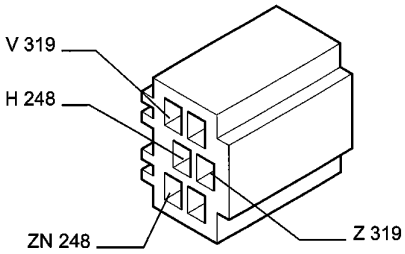
## 55.

### 48B Radio receiver with clock



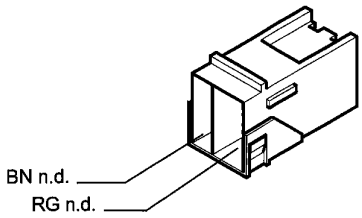

P4F932N01

### 48C Radio receiver with clock



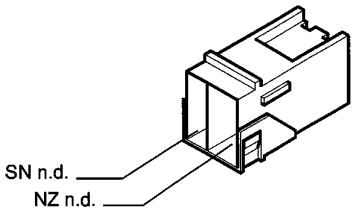

P4F932N02

### 49 Left front speaker (tweeter)



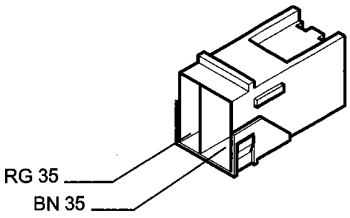

P4F932N03

### 50 Right front speaker (tweeter)



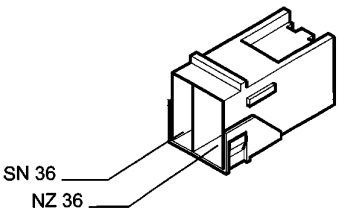

P4F932N04

### 51 Speaker in left front door



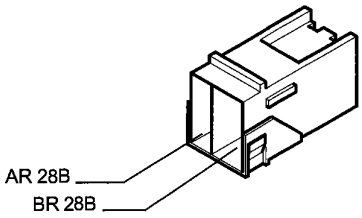

P4F932N05

### 52 Speaker in right front door



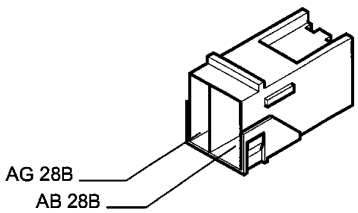

P4F932N06

### 53 Left rear speaker




P4F932N07

### 54 Right rear speaker



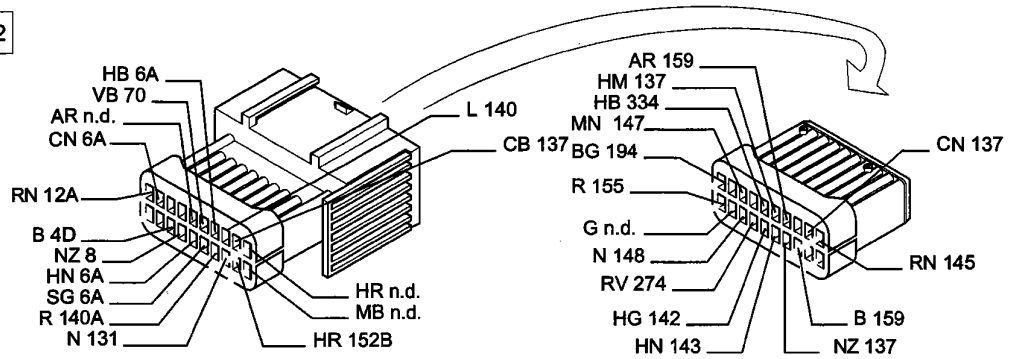

P4F932N08




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## 55 Front/engine lead connection

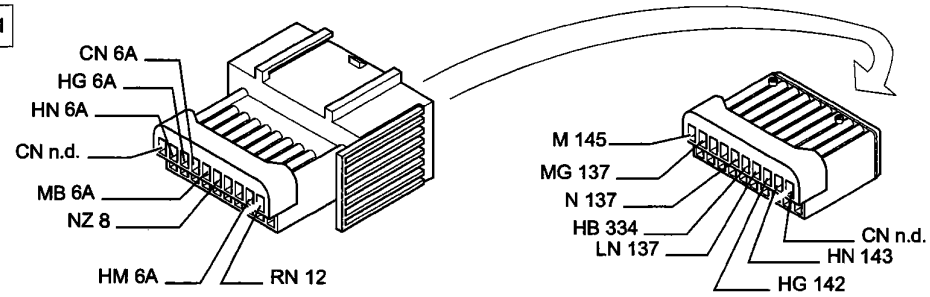
1242




P4F933N01

## 55 Front/engine lead connection

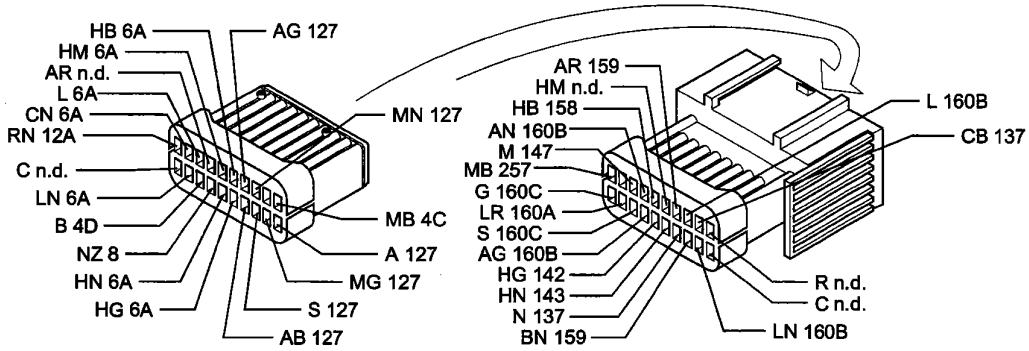
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P4F933N02

## 55 Front/engine lead connection

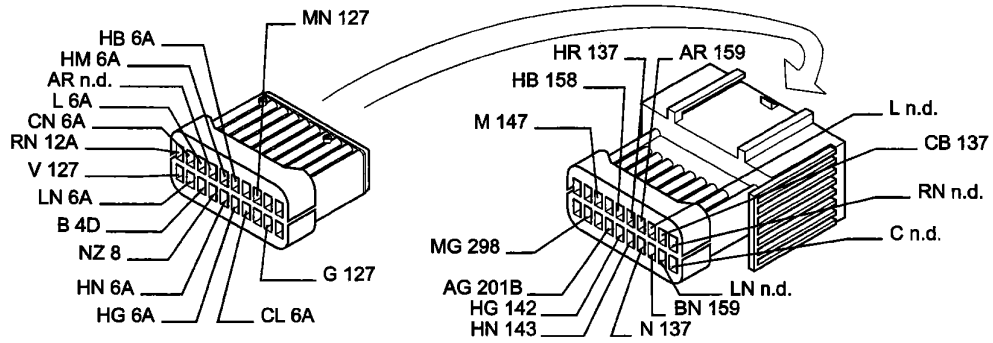
1747




P4F933N03

## 55 Front/engine lead connection

1910-75




P4F933N04

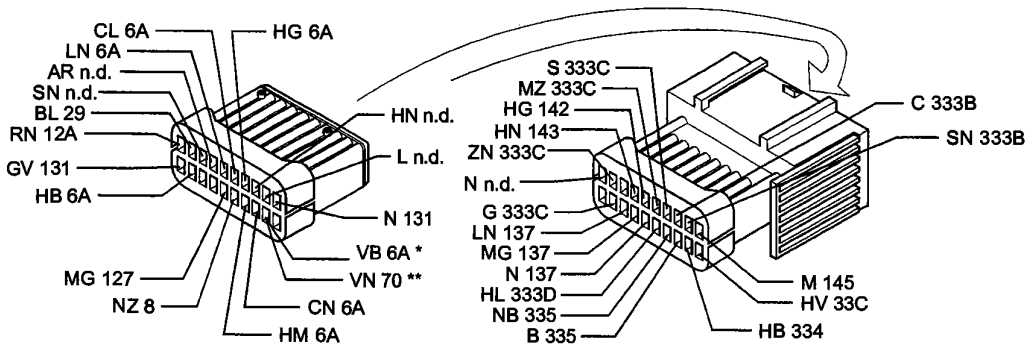


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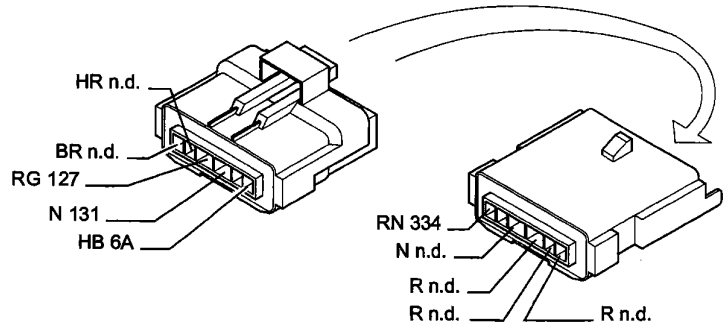
## 55A Front/engine lead connection

JTD



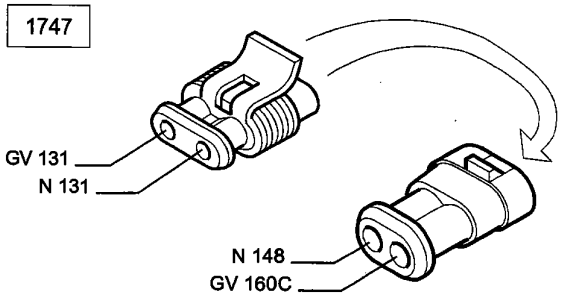

## 55A Front/engine lead connection

1747 agg.'99



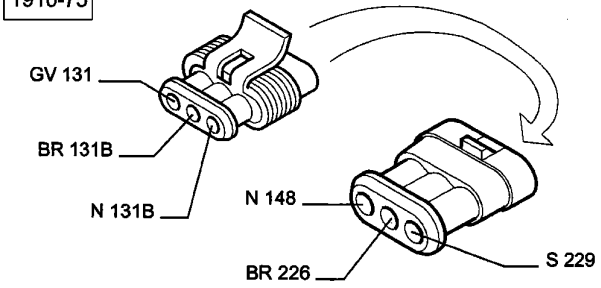

## 55A Front/engine lead connection

1747



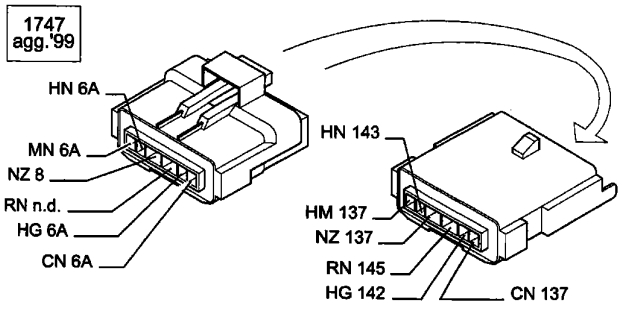

## 55A Front/engine lead connection

1910-75



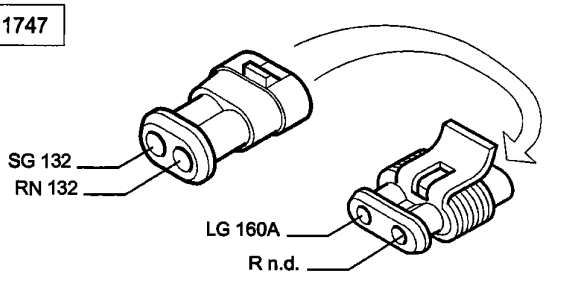

## 55B Front/engine lead connection

1747 agg.'99




## 55B Front/engine lead connection

1747




(*) from Nov. 99

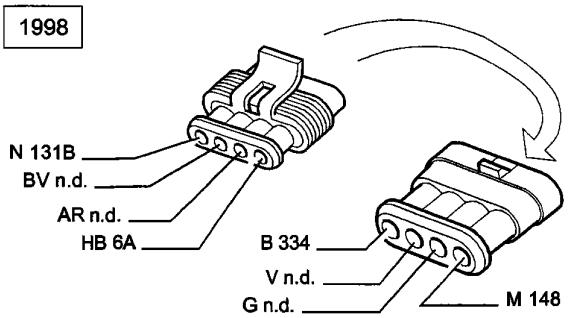
(**) up to Nov. 99




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## 55C Front/engine lead connection

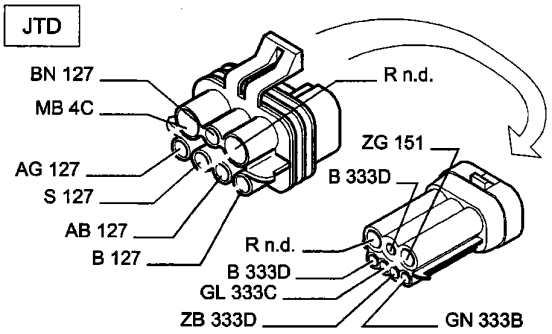
1998




P4F935N01

## 55C Front/engine lead connection

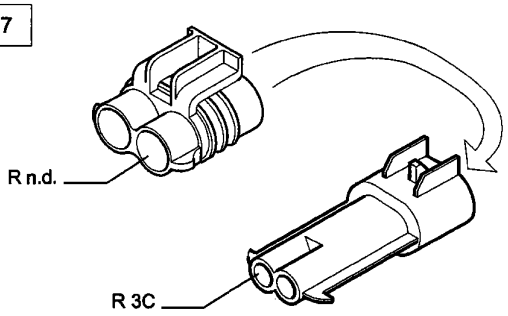
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P4F935N02

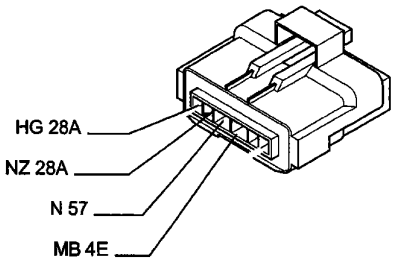
## 55C Front/engine lead connection

1747



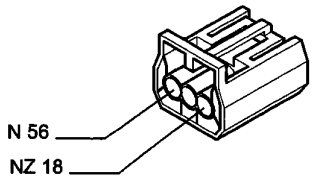

P4F935N03

## 56 Fuel gauge unit



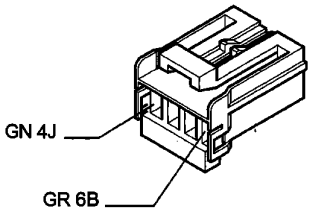

P4F935N04

## 57 Inertia switch



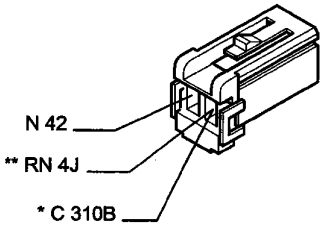

P4F935N05

## 58 Control panel light dimmer



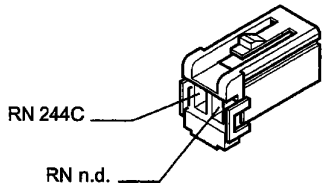

P4F935N06

## 64 Glove compartment light bulb with built in switch




P4F935N09

## 65 Luggage compartment light




Marea

P4F935N08

(*) from Nov. 99

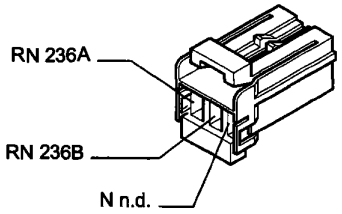
(**) Up to Nov. 99



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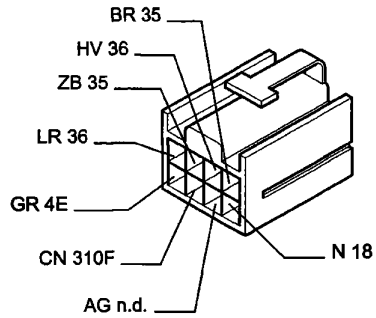
## 65 Luggage compartment light




Marea Weekend

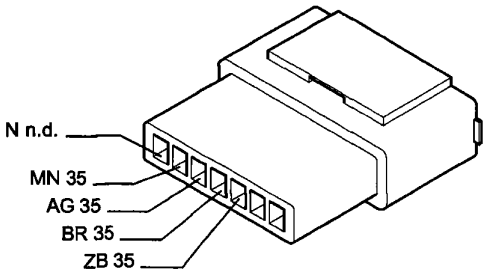
P4F936N01

## 66 Electrically-adjustable door mirror control buttons



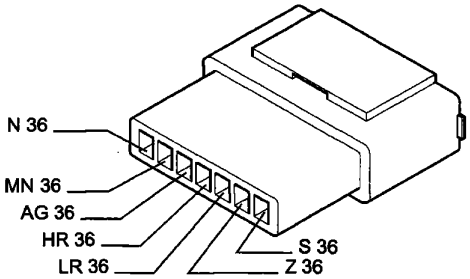

P4F936N02

## 67 Left door mirror



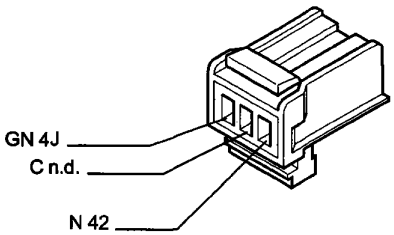

P4F936N03

## 68 Right door mirror




P4F936N04

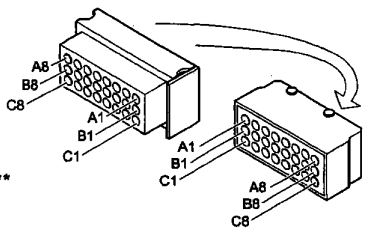
## 69 Cigar lighter




P4F934N05

## 70 Connection between dashborad/front cables

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| A1 | RN 4C | B1 | M 29 | C1 | | | | |
| A2 | VG 127 | B2 | V 328 | C2 | HR 100B | | | |
| A3 | H 100B * | B3 | AG n.d. | C3 | HN 100B | | | |
| A3 | VN 55 ** | B4 | LN 100B | C4 | HG 100B | | | |
| A4 | HL 6A | B5 | AV 4D * | C5 | HV 100B | | | |
| A5 | CB 100A | B6 | AB 4D * | C6 | GL n.d. ** | | | |
| A6 | S 100B | B7 | AN 4C | C7 | GV 13 ** | | | |
| A7 | V 100A | B8 | | C8 | | | | |
| A8 | | | | | | | | |




| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| A1 | RN 120 | B1 | M n.d. | C1 | | | | |
| A2 | VG 120 | B2 | V 28A | C2 | HR 310B ** | HR 28B * | | |
| A3 | VB 6B ** | B3 | AG 4I | C3 | HN 310B ** | HN 28B * | | |
| A3 | H 6B * | B4 | AB 4I ** | C4 | HG 310C ** | HG 28B * | | |
| A4 | HL120 | B4 | G 310C * | C5 | HV 310C ** | HV 28B * | | |
| A5 | CB 28A | B5 | AV 6C ** | C6 | GL 6C ** | | | |
| A6 | R 310B | B6 | AB 6C ** | C7 | GV 6C ** | | | |
| A7 | A 34A | B7 | AN 120 | C8 | | | | |
| A8 | | B8 | | | | | | |

With Check Panel, with alarm

P4F936N07

(*) from Nov. 99

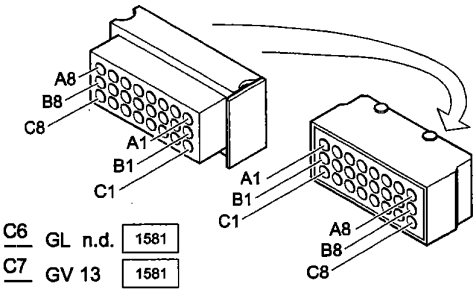
(**) up to Nov. 99




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## 70 Connection between dashborad/front cables

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A1 | RN 4C | B1 | M 29 | C6 | GL n.d. 1581 | | |
| A2 | VG 127 | B2 | V 328 | C7 | GV 13 1581 | | |
| A3 | VB 55 ** 1242 | B6 | AG 6A | | | | |
| A3 | VB 195A ** 1581 | B4 | G n.d. | | | | |
| A4 | HL 26A | B5 | AV 4D 1581 | | | | |
| | | B6 | AB 4D 1581 | | | | |
| | | B7 | LR 4C 1242 | | | | |
| | | B7 | AN 4C 1581 | | | | |

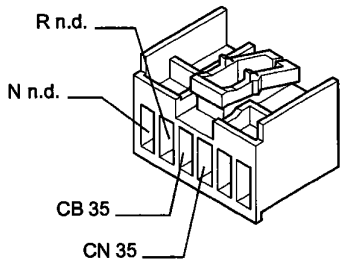



| | | | | | |
|---|---|---|---|---|---|
| A1 | RN 120 | | | C1 | |
| A2 | VG 120 | B1 | M n.d. | C2 | |
| A3 | VB 6B ** | B2 | V 28A | C3 | |
| A4 | HL120 | B6 | AG 4I | C4 | |
| A5 | | B4 | LB n.d. | C5 | |
| A6 | | B6 | GL | C6 | GL |
| A7 | | B6 | GV | | |
| A8 | | B7 | AN 120 | C7 | GV |
| | | B8 | | C8 | |

Without Check Panel, without Alarm

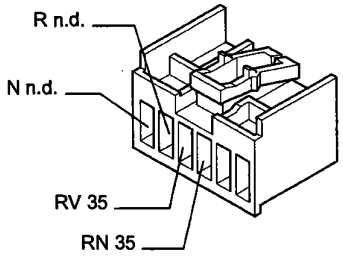
P4F937N08

## 73A Pushbutton unit for front electric windows on left arm-rest



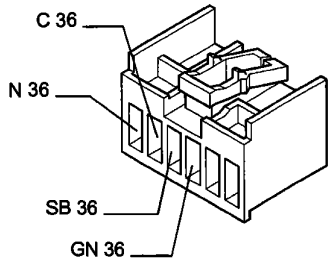

P4F937N02

## 73B Pushbutton unit for front electric windows on left arm-rest



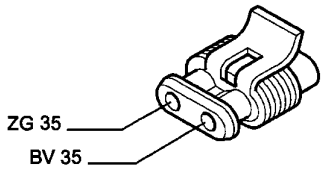

P4F937N03

## 74 Pushbutton unit for right front electric windows on right arm-rest



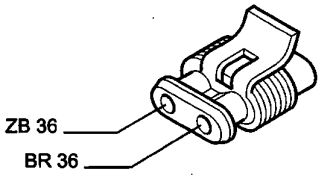

P4F937N04

## 76 Left front electric window motor



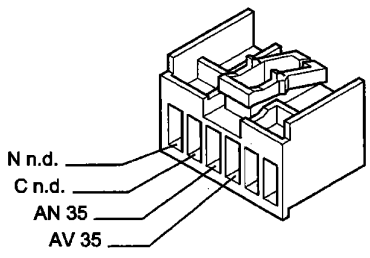

P4F937N05

## 77 Right front electric window motor




P4F937N06

## 78A Pushbutton unit for rear electric windows on left front door




P4F937N07

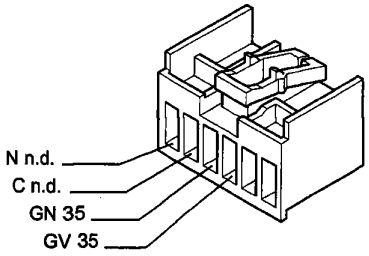
(**) up to Nov. 99



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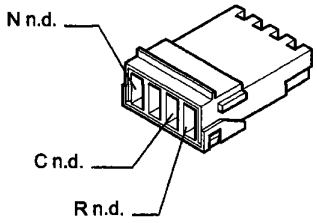
# 55.

**78B** Pushbutton unit for rear electric windows on left front door



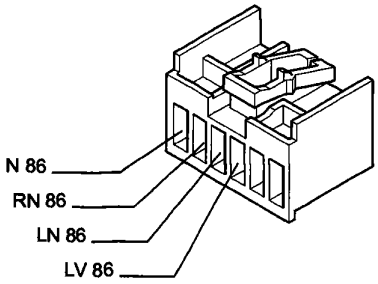

P4F938N01

**80** Rear electric window inhibition switch



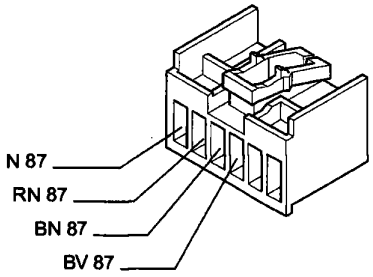

P4F938N02

**82** Pushbutton unit for left rear electric windows on left front door



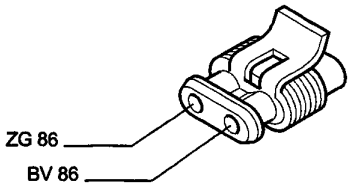

P4F938N03

**83** Pushbutton unit for right rear electric windows on right rear door



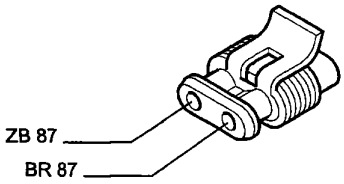

P4F938N04

**84** Left rear electric window motor



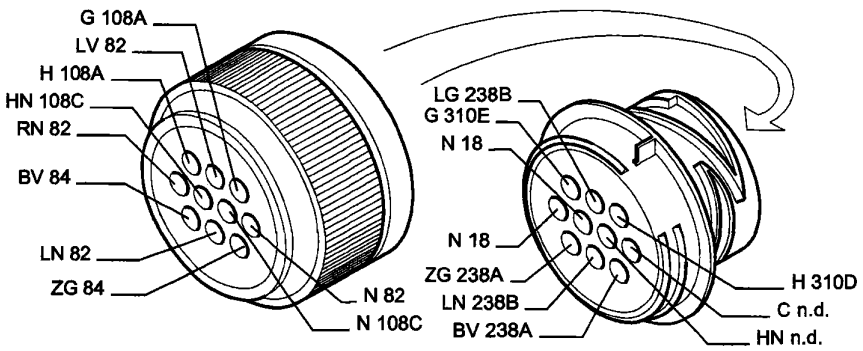

P4F938N05

**85** Right rear electric window motor




P4F938N06

**86** Rear/left rear door lead connection

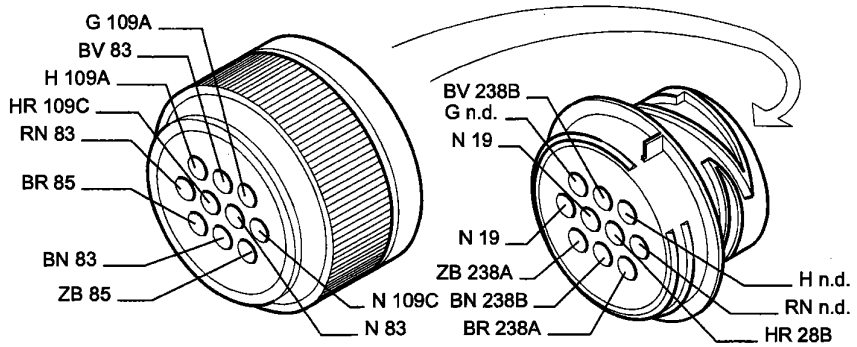



P4F938N07



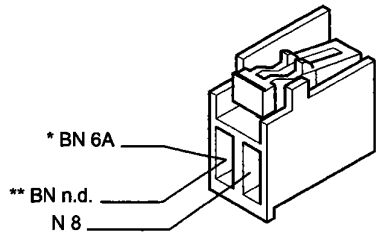

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## 87 Connection between rearl/right rear door cables



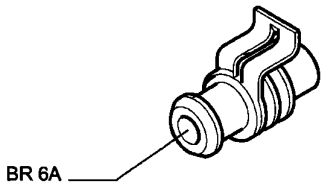

P4F939N01

## 88 Insufficient brake fluid level sensor



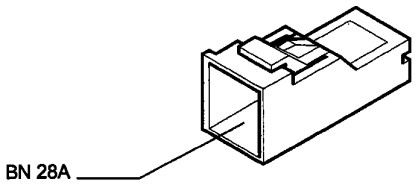

P4F939N08

## 89A Left brake pad wear sensor cable connection



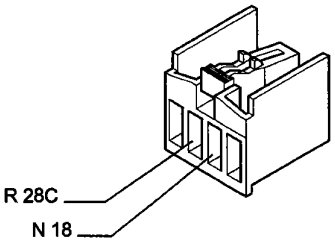

P4F939N03

## 90 Switch signalling handbrake applied




P4F939N04

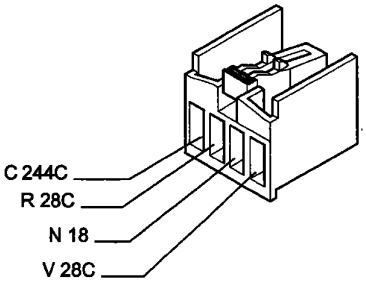
## 92A Electric sun-roof lead connection




Without automatic window closure

P4F937N05

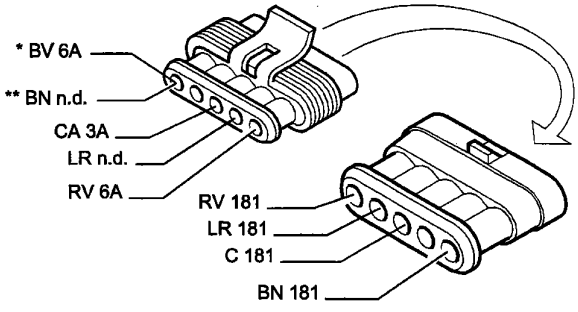
## 92A Electric sun-roof lead connection




With automatic window closure

P4F939N06

## 95 Connection between front cables/anti-lock brakes A.B.S. leads




P4F939N09

(*) from Nov. 99

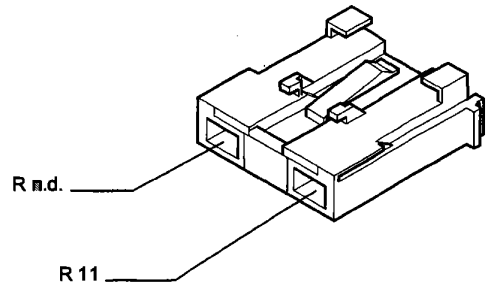
(**) up to Nov. 99



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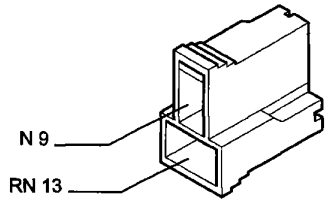
# 55.

**96** Power fuse for anti-lock brakes



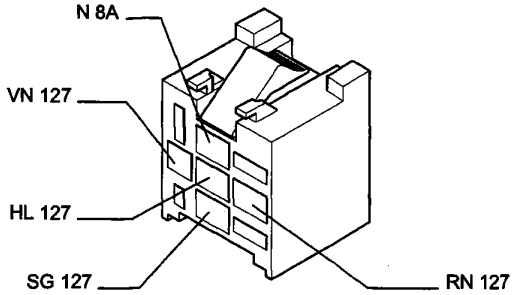

P4F940N01

**97** Electric headlamp washer pump



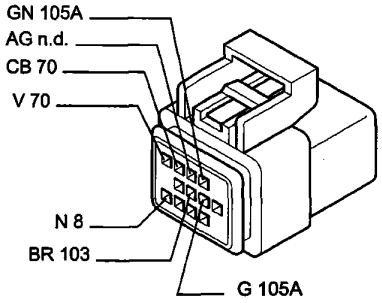

P4F940N02

**98** Headlamp washer intermittence



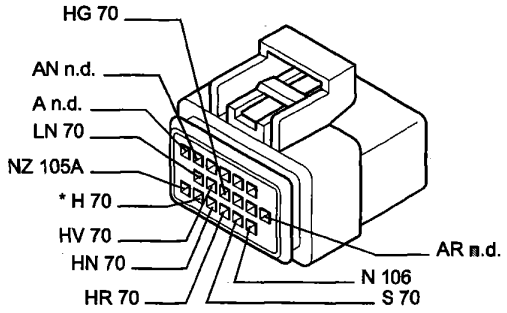

P4F940N03

**100A** Alarm electronic control unit



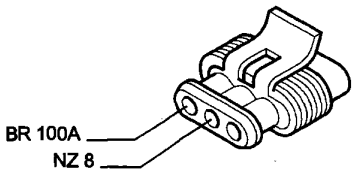

P4F940N04

**100B** Alarm electronic control unit



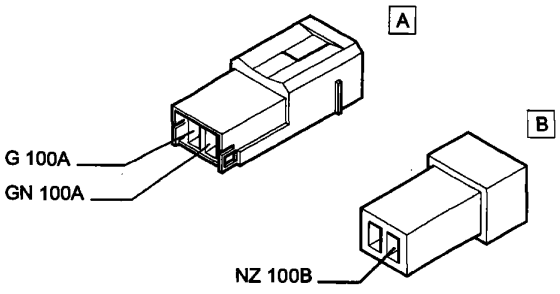

P4F940N09

**103** Tester socket for injection alarm



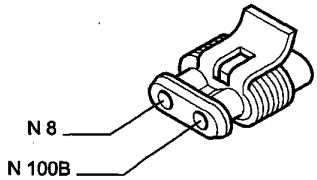

P4F940N06

**105** Alarm deactivation switch




P4F940N07

**106** Alarm switch on engine bonnet



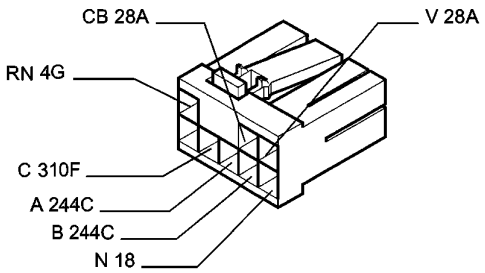

P4F940N08

(*) from Nov. 99



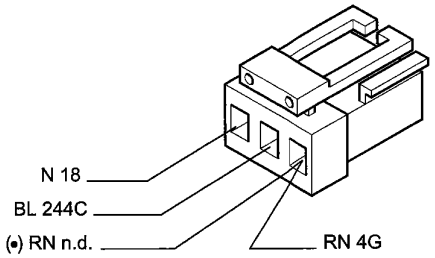

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## 107A Central locking remote control receiver




P4F941N01

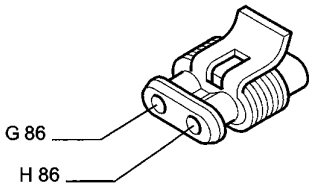
## 107B Vehicle interior front courtesy light




• Marea Weekend

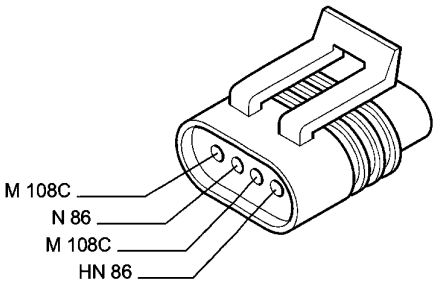
P4F941N02

## 108A Left rear central locking



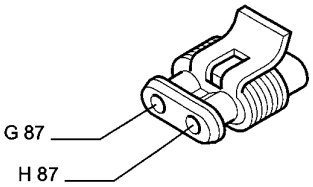

P4F941N03

## 108C Left rear central locking



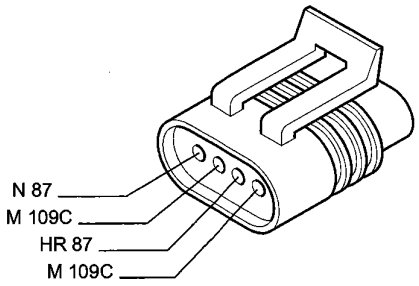

P4F941N04

## 109A Right rear central locking



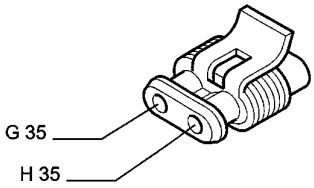

P4F941N05

## 109C Right rear central locking



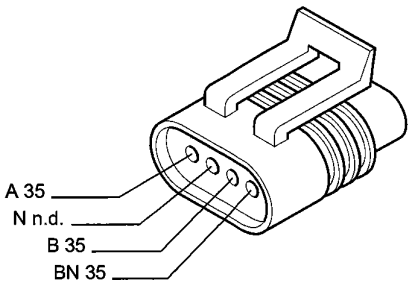

P4F941N06

## 110A Left front central locking




P4F941N07

## 110B Left front central locking




With automatic window closing

P4F941N08

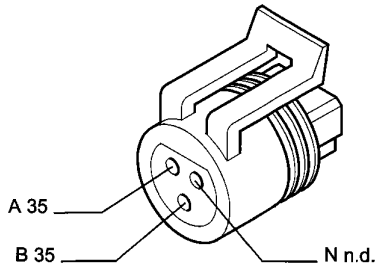
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# 55.

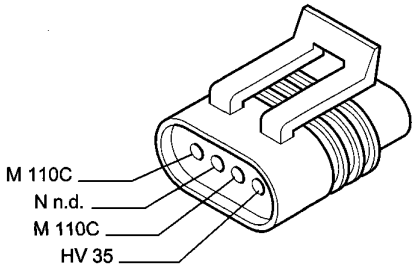
## 110B Left front central locking




Without automatic window closing

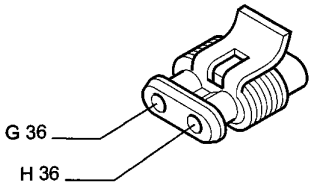
P4F942N01

## 110C Left front central locking



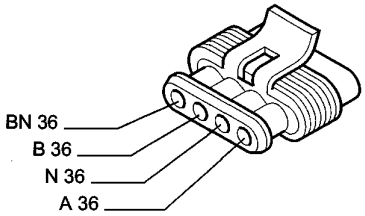

P4F942N02

## 111A Right front central locking




P4F942N03

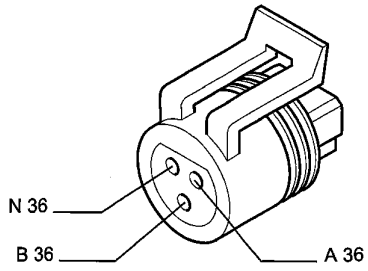
## 111B Right front central locking




With automatic window closing

P4F942N04

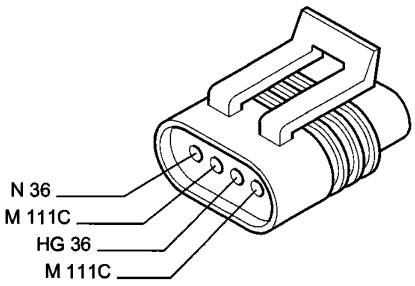
## 111B Right front central locking




Without automatic window closing

P4F942N05

## 111C Right front central locking

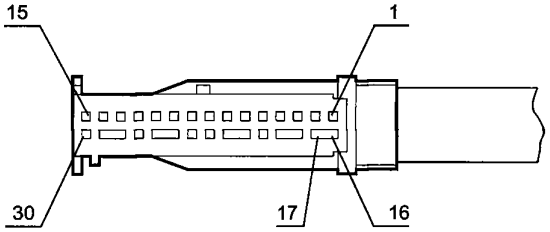



P4F942N06

## 114 Air Bag electronic control unit

| | | | |
|---|---|---|---|
| 1 | LN 231 | 11 | VN 239 |
| 2 | L 231 | 13 | C 117 |
| 3 | GN 115 | 14 | N n.d. |
| 4 | G 115 | 15 | R 117 |
| 6 | M 240 | 23 | BV 355 |
| 7 | MN 240 | 27 | BN 355 |
| 8 | NZ 130 | 30 | n.d. |
| 9 | BR 130 | | |
| 10 | V 239 | | |

Without Side Bag



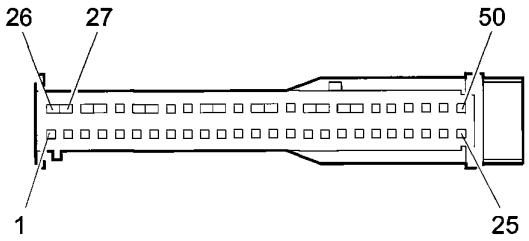

P4F942N07




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## 114 Air Bag electronic control unit

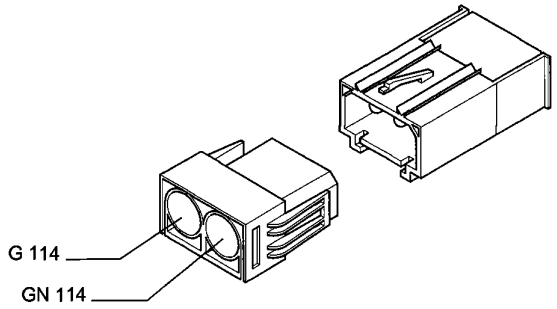
| | | | | | |
|---|---|---|---|---|---|
| 1 | LN 231 | 15 | R n.d. | 33 | C 117 |
| 2 | L 231 | 16 | HB 352 | 34 | N n.d. |
| 3 | GN 115 | 17 | HL 352 | 37 | BN 355 |
| 4 | G 115 | 18 | HG 353 | 40 | N n.d. |
| 6 | N 240 | 19 | HL 353 | | |
| 7 | MN 240 | 22 | ZB 355 | | |
| 9 | BR 130 | 23 | ZN 355 | | |
| 10 | V 239 | 24 | RN 355 | | |
| 11 | VN 239 | 25 | V 355 | | |




With Side Bag

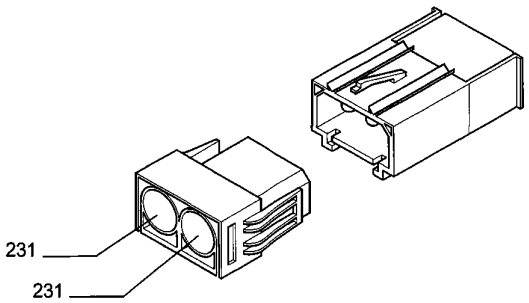
4F943N01

## 115 Passenger Air Bag



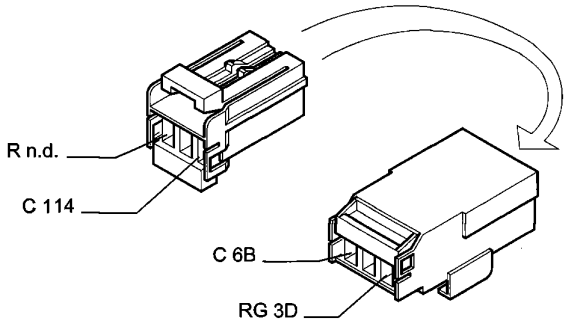

P4F943N02

## 116 Driver's Air Bag



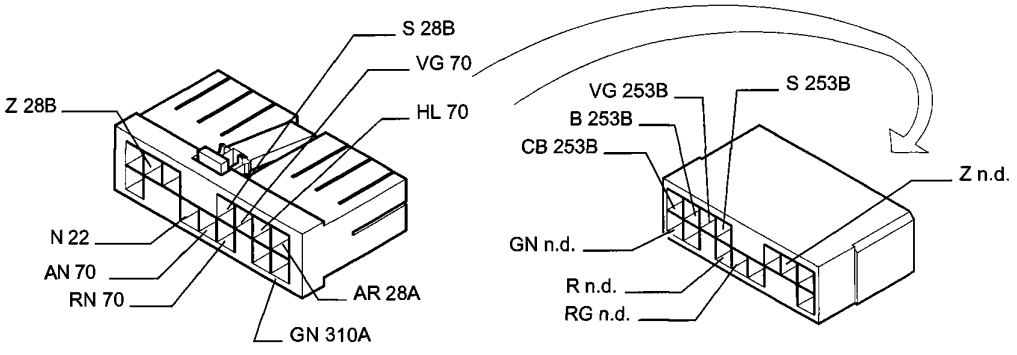

P4F943N03

## 117 Connection between Air Bag/dashboard cables




P4F943N04

## 120 Connection for air conditioning unit cables



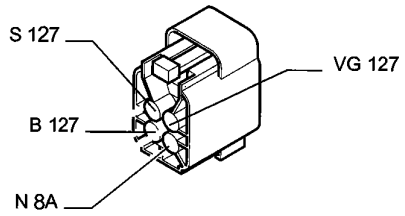

P4F943N05



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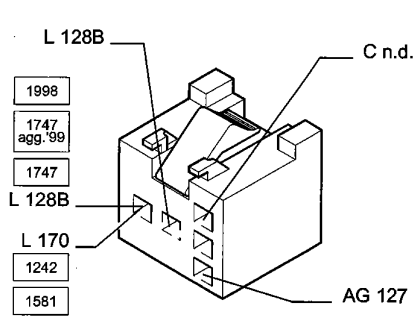
**121** Three stage pressure switch

1747



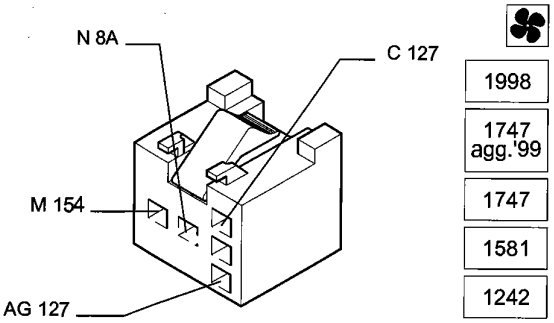

P4F944N01

**122** Engine cooling fan low speed relay




P4F944N02

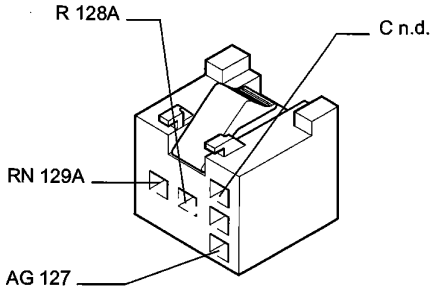
**122** Engine cooling fan low speed relay




P4F944N03

**122** Engine cooling fan low speed relay

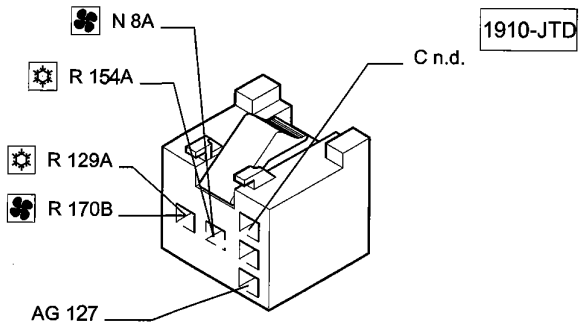
2387-JTD




P4F944N04

**122** Engine cooling fan low speed relay

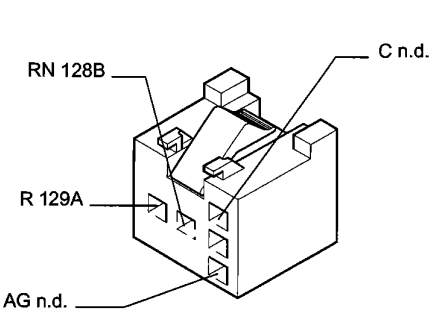
1910-JTD




P4F944N05

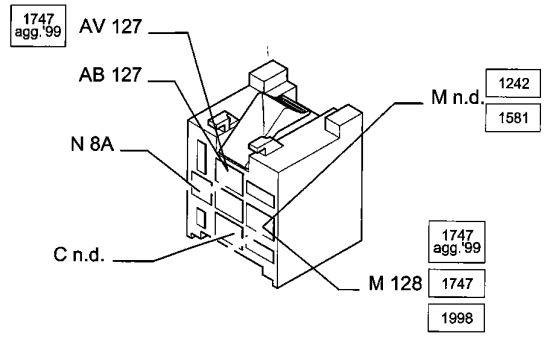
**122** Engine cooling fan low speed relay

1910-75




P4F944N06

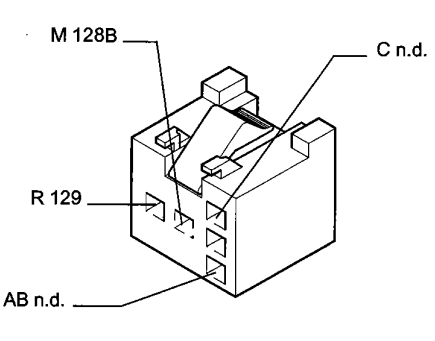
**123** Engine cooling fan high speed timer




P4F944N07

**123** Engine cooling fan high speed timer

2387-JTD

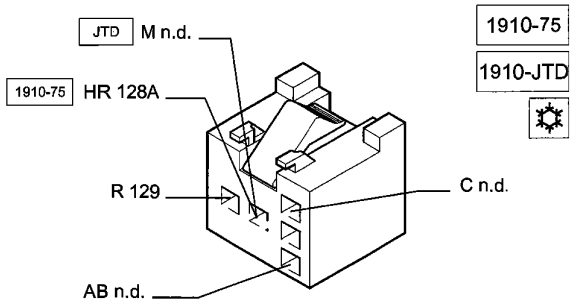



P4F944N08



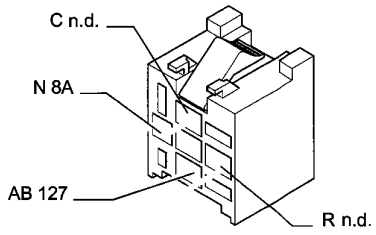

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## 123 Engine cooling fan high speed timer



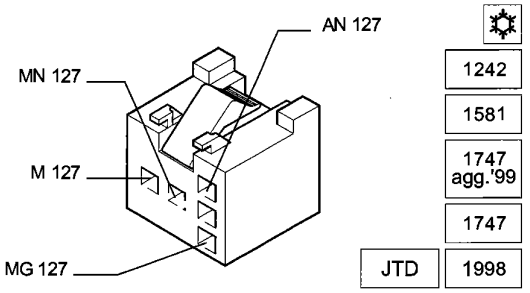

P4F945N01

## 123 Engine cooling fan high speed timer



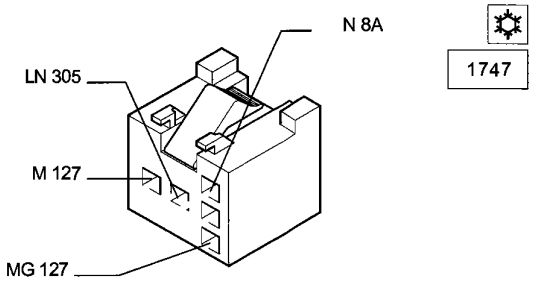

P4F945N02

## 124 Air conditioning compressor relay feed




P4F945N02

## 124 Air conditioning compressor relay feed



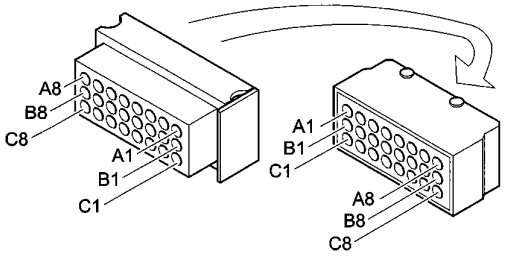

P4F945N03

## 127 Connection between left front cable/cable on relay holder bracket

1242

| | |
|---|---|
| A2 | RN 13 |
| A4 | AB 140A |
| A5 | AG 140A |
| A6 | M 3A |
| A7 | MN 55 |
| A8 | C n.d. |

| | |
|---|---|
| B2 | AR n.d. |
| B3 | MG 140A |
| B4 | S 140A |
| B5 | VN 3A |
| B6 | B 140A |
| B7 | VG 70 |
| C2 | BN 140A |
| C3 | HL n.d. |
| C4 | SG n.d. |




| | |
|---|---|
| A2 | RN 98 |
| A4 | AV 123 |
| A5 | AG 122 |
| A6 | M 124 |
| A7 | MN 124 |
| A8 | C n.d. |

| | |
|---|---|
| B2 | AN 124 |
| B3 | MG 124 |
| B4 | S 365 |
| B5 | VN 98 |
| B6 | B 365 |
| B7 | VG 365 |
| C2 | BN 365 |
| C3 | HL 98 |
| C4 | SG 98 |

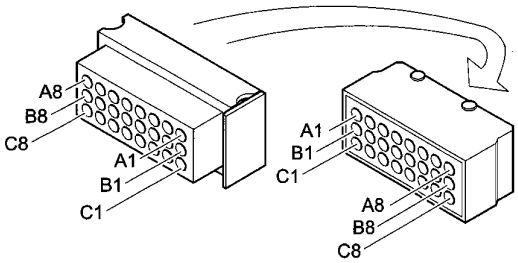
P4F945N05

## 127 Connection between left front cable/cable on relay holder bracket

1581

| | |
|---|---|
| A2 | RN 13 |
| A4 | AB 195A |
| A5 | AG 195A |
| A6 | M 3A |
| A7 | MN 13 |
| A8 | C n.d. |

| | |
|---|---|
| B2 | AN n.d. |
| B3 | MG 195A |
| B4 | S 195A |
| B6 | VN 3A |
| B5 | B 195A |
| B7 | VG 70 |
| C2 | BN 195A |
| C3 | HL n.d. |
| C4 | SG n.d. |




| | |
|---|---|
| A2 | RN 98 |
| A4 | AV 123 |
| A5 | AG 122 |
| A6 | M 124 |
| A7 | MN 124 |
| A8 | C n.d. |

| | |
|---|---|
| B2 | AN 124 |
| B3 | MG 124 |
| B4 | S 365 |
| B5 | VN 98 |
| B6 | B 365 |
| B7 | VG 365 |
| C2 | BN 365 |
| C3 | HL 98 |
| C4 | SG 98 |

P4F945N06



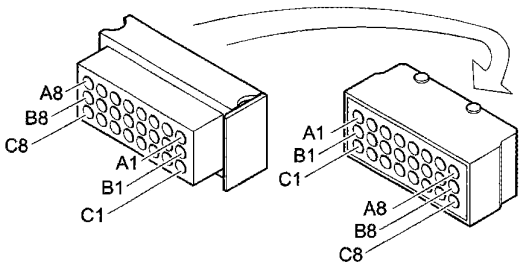
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# 55.

## 127 Connection between left front cable/cable on relay holder bracket

1747

| | | | | | |
|---|---|---|---|---|---|
| A2 | RN 13 | B2 | AN n.d. | A2 | RN 98 |
| A4 | AB 55 | B3 | MG 55 | A4 | AV 123 ☼ |
| A5 | AG 55 | B4 | S 55 | A5 | AG 122 |
| A6 | M 3A | B5 | VN 3A | A6 | M 124 ☼ |
| A7 | MN 55 | B6 | B 55 | A7 | MN 124 ☼ |
| A8 | C n.d. | B7 | VG 70 | A8 | C n.d. |
| | | C3 | HL n.d. | | |
| | | C4 | SG n.d. | | |



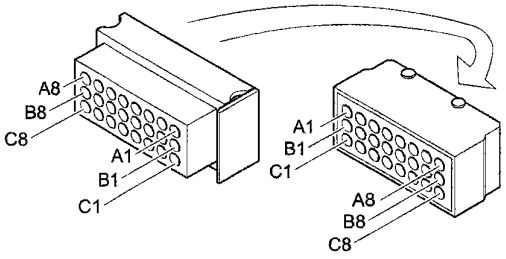

| | | | |
|---|---|---|---|
| B2 | AN 124 ☼ | | |
| B3 | MG 124 ☼ | | |
| B4 | S 121 ☼ | | |
| B5 | VN 98 | | |
| B6 | B 121 ☼ | | |
| B7 | VG 121 ☼ | | |
| C3 | HL 98 | | |
| C4 | SG 98 | | |

P4F946N01

## 127 Connection between left front cable/cable on relay holder bracket

1747 agg.99

| | | | | | |
|---|---|---|---|---|---|
| A1 | R n.d. | B3 | MG 160A | A1 | R n.d. |
| A2 | RN 13 | B4 | S 160A | A2 | RN 98 |
| A3 | BG 160A | B5 | VN 3A | A3 | BG151 |
| A4 | AB 160A | B6 | B 160A | A4 | AV 123 ☼ |
| A5 | AG 160A | B7 | VG 70 | A5 | AG 122 |
| A6 | M 3A | B8 | BR n.d. | A6 | M 124 ☼ |
| A7 | MN 13 | C2 | BN 160A | A7 | MN 124 ☼ |
| A8 | C n.d. | C8 | HL n.d. | A8 | C n.d. |
| B1 | MB 4C | C4 | SG n.d. | B1 | MB 151 |
| | | C5 | HR n.d. | B2 | AN 124 ☼ |
| | | C7 | GL 160A | B3 | MG 124 ☼ |



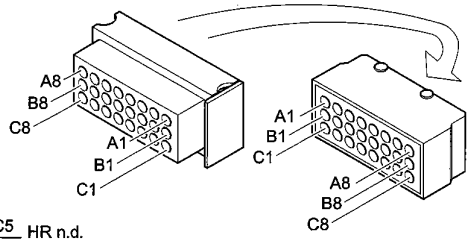

| | | | |
|---|---|---|---|
| B4 | S 365 ☼ | | |
| B5 | VN 98 | | |
| B6 | B 365 ☼ | | |
| B7 | VG 365 ☼ | | |
| B8 | BR 152B | | |
| C2 | BN 365 ☼ | | |
| C3 | HL 98 | | |
| C4 | SG 98 | | |
| C5 | HR 152A | | |
| C7 | GL 368 | | |

P4F946N02

## 127 Connection between left front cable/cable on relay holder bracket

1998

| | | | | | |
|---|---|---|---|---|---|
| A1 | R n.d. | B1 | MB 4C | A1 | R n.d. |
| A2 | RN 13 | B2 | AN n.d. | A2 | RN 98 |
| A3 | BG 190A | B2 | MG 190A | A3 | BV 151 |
| A4 | AB 190A | B4 | S 190A | A4 | AB 123 ☼ |
| A5 | AG 190A | B5 | VN 3A | A5 | AG 122 |
| A6 | M 3A | B6 | B 190A | A6 | M 124 ☼ |
| A7 | MN 55 | B7 | VG 70 | A7 | MN 124 ☼ |
| A8 | C n.d. | C2 | BN190A | A8 | C n.d. |
| | | C3 | HL n.d. | B1 | MB 151 |
| | | C4 | SG n.d. | B2 | AN 124 ☼ |
| | | C5 | HR n.d. | B3 | MG 124 ☼ |
| | | C6 | AR n.d. | | |
| | | C7 | G 190A | | |



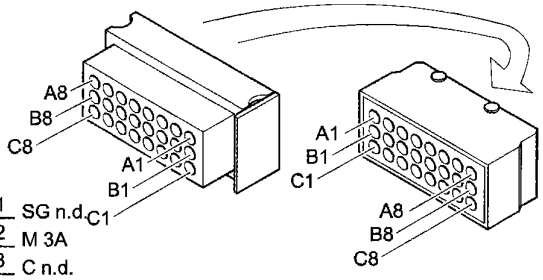

| | | | |
|---|---|---|---|
| B4 | S 365 ☼ | | |
| B5 | VN 98 | | |
| B6 | B 365 ☼ | | |
| B7 | VG 365 ☼ | | |
| C2 | BN 365 | | |
| C3 | HL 98 | | |
| C4 | SG 98 | | |
| C5 | HR 152A | | |
| C6 | AR 152B | | |
| C7 | G 150 | | |

P4F946N03

## 127 Connection between left front cable/cable on relay holder bracket

JTD

| | | | | | |
|---|---|---|---|---|---|
| A1 | BR n.d. | B1 | RN 13 | A1 | BR 303 |
| A2 | MN 13 | B2 | HL n.d. | A2 | MN 124 ☼ |
| A3 | AR n.d. | B3 | S 55C | A3 | AR 124 ☼ |
| A4 | MG 55A | B4 | B 55C | A4 | MG 124 ☼ |
| A5 | GN 289 | B5 | VG 70 | A5 | GN 304 |
| A6 | HN n.d. | B6 | N 8 | A6 | HN 304 |
| A7 | AG 55C | B7 | BN 55C | A7 | AG 122 |
| A8 | RG 290 | B8 | VN 3A | A8 | RG 304 |
| | | C1 | SG n.d. | B1 | RN 98 |
| | | C2 | M 3A | B2 | HL 98 |
| | | C3 | C n.d. | B3 | S 365 |
| | | C4 | AB 55C | | |
| | | C8 | R n.d. | | |




| | | | |
|---|---|---|---|
| B4 | B 365 | | |
| B5 | VG 365 | | |
| B6 | N 365 | | |
| B7 | BN 365 | | |
| B8 | VN 98 | | |
| C1 | SG 98 | | |
| C2 | M 124 ☼ | | |
| C3 | C n.d. | | |
| C4 | AB n.d. | | |
| C8 | R 152 | | |

P4F946N04



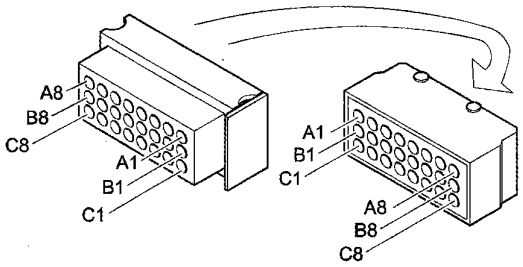

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## 127 Connection between left front cale/cable on relay holder bracket

1910-75

A2 MN 55
A4 MG 233
B1 RN 13
B2 HL n.d.
B3 S 233
B5 VG 70
B8 VN 3A

C1 SG n.d.
C2 L 3A
C3 C n.d.
C5 V 55
C6 MB 4C
C7 G 55

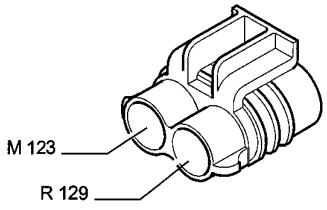



A2 MN 305
A4 MG 124
B1 RN 98
B2 HL 98
B5 S 365
B5 VG 365
B8 VN 98

C1 SG 98
C2 M 124
C3 C n.d.
C5 V 370
C6 MB 370
C7 MG 305

P4F947N01

## 128A Connection between front/radiator cables

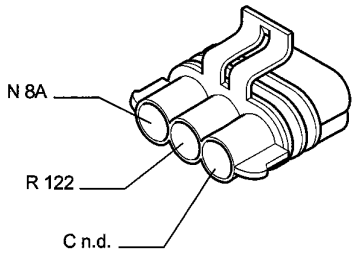



1998
1747 agg.'99
1747

P4F947N02

## 128A Connection between front/radiator cables

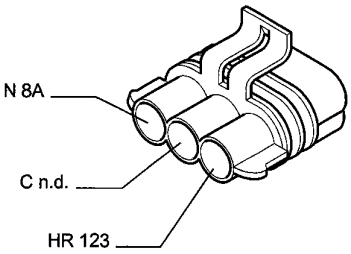
2387-JTD




P4F947N03

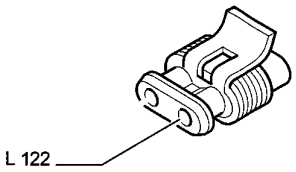
## 128A Connection between front/radiator cables

1910-75




P4F947N04

## 128B Connection between front/radiator cables

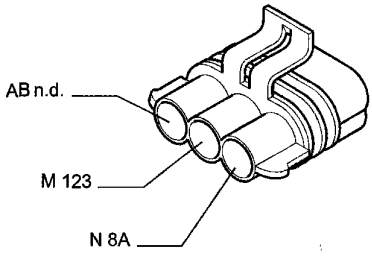



1998
1747 agg.'99
1747

P4F947N05

## 128B Connection between front/radiator cables

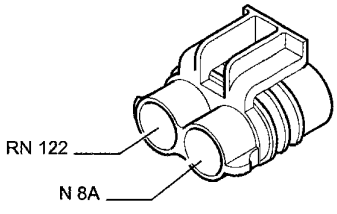
2387-JTD




P4F947N06

## 128B Connection between front/radiator cables

1910-75




P4F947N07

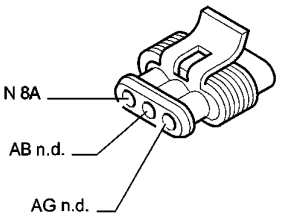


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# 55.

## 128C Connection between front/radiator cables

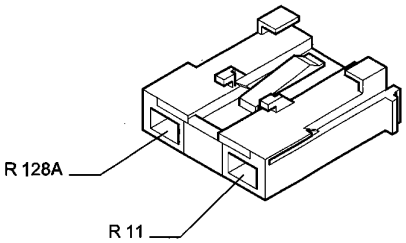
1910-75




P4F948N01

## 129 Engine cooling fan protective power fuse

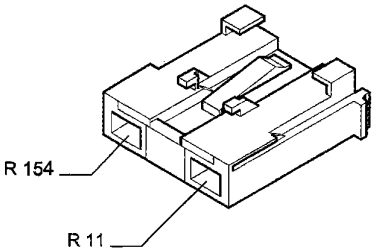
1747 agg.'99
1747
1998




P4F948N02

## 129 Engine cooling fan protective power fuse

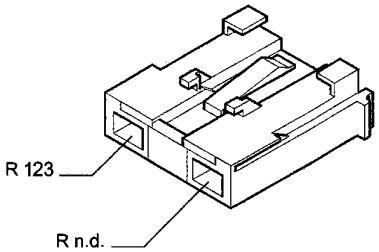
1242
1581
1747 agg.'99
1747
1998




P4F948N03

## 129 Engine cooling fan protective power fuse

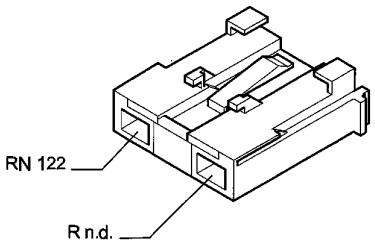
1910-75
1910-JTD
2387-JTD




P4F948N04

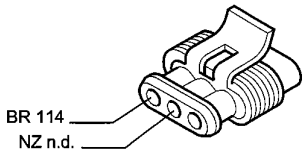
## 129A 2nd Engine cooling fan protective power fuse

1910-75
1910-JTD
2387-JTD




P4F948N05

## 130 Diagnostic socket for Air Bag




P4F948N06

## 131 FIAT CODE electronic control unit

2 MN 6A

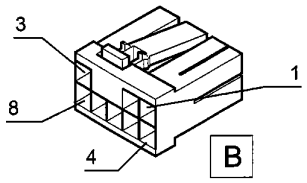
3 RV n.d. (1998, 1242, 1747 agg.'99) RV 3A (JTD, 1910-75, 1747)

4 N 55A (1747 agg.'99, 1747, 1910-75, JTD) N 55C (1998) N 193 (1581) N 55 (1242)

5 BR 55A (1910-75)

6 GV 190 (1998) GV 55A (1910-75, 1747) G 55 (JTD) GV 195A (1581) GV 140A (1242) GV 160A (1747 agg.'99)

8 C n.d.



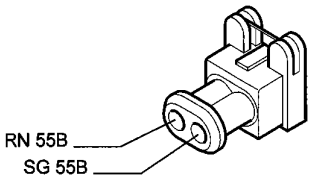

P4F948N07



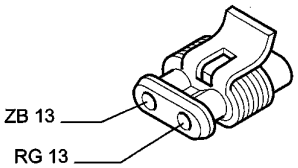

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## 132 Petrol vapour cut out solenoid valve

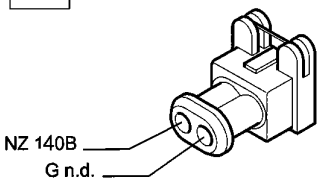
1747

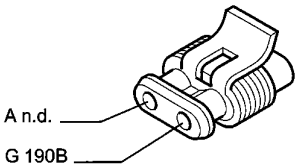



1581



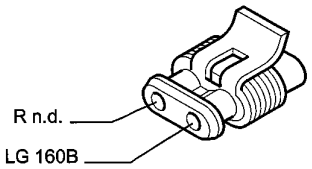

1242



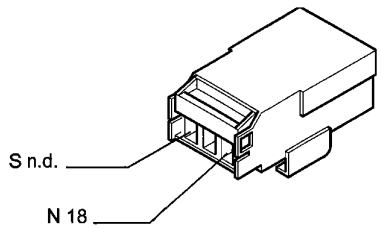

1998

1747 agg.99



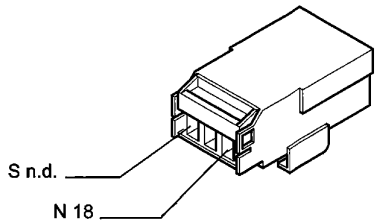

P4F949N03

## 134 Connection between rear/driver's heated seat cables




P4F949N02

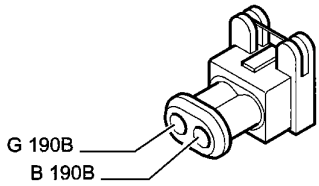
## 135 Connection between rear/passenger heated seat cables




P4F949N03

## 136A 2nd detonation sensor

1998



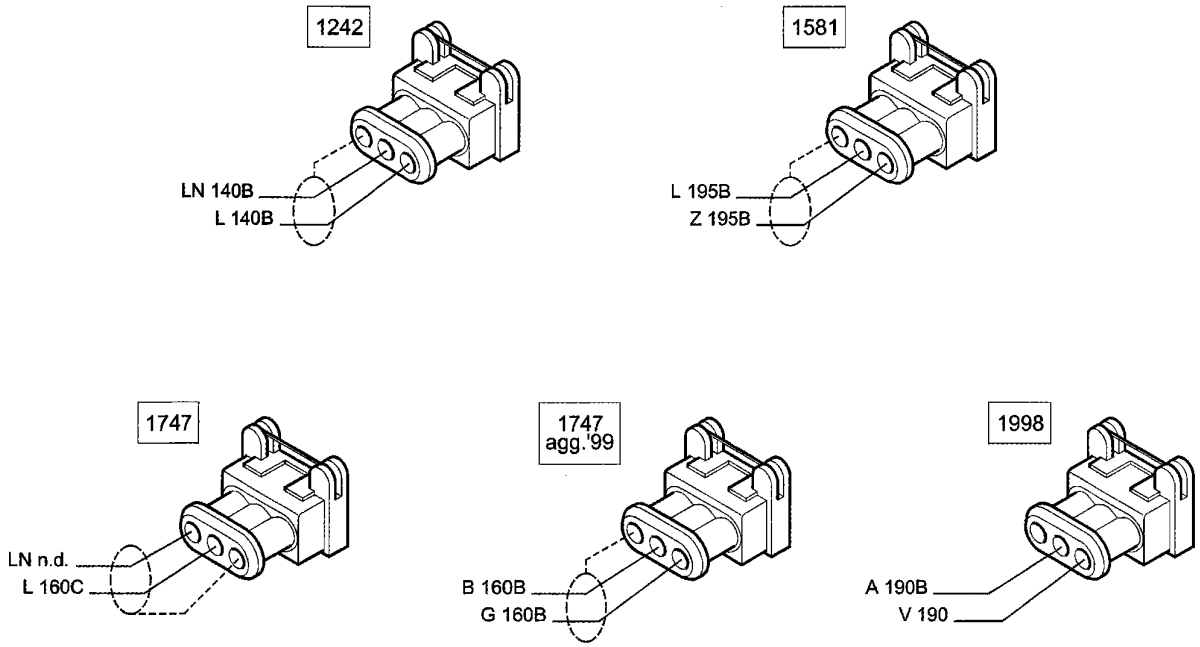

P4F949N04



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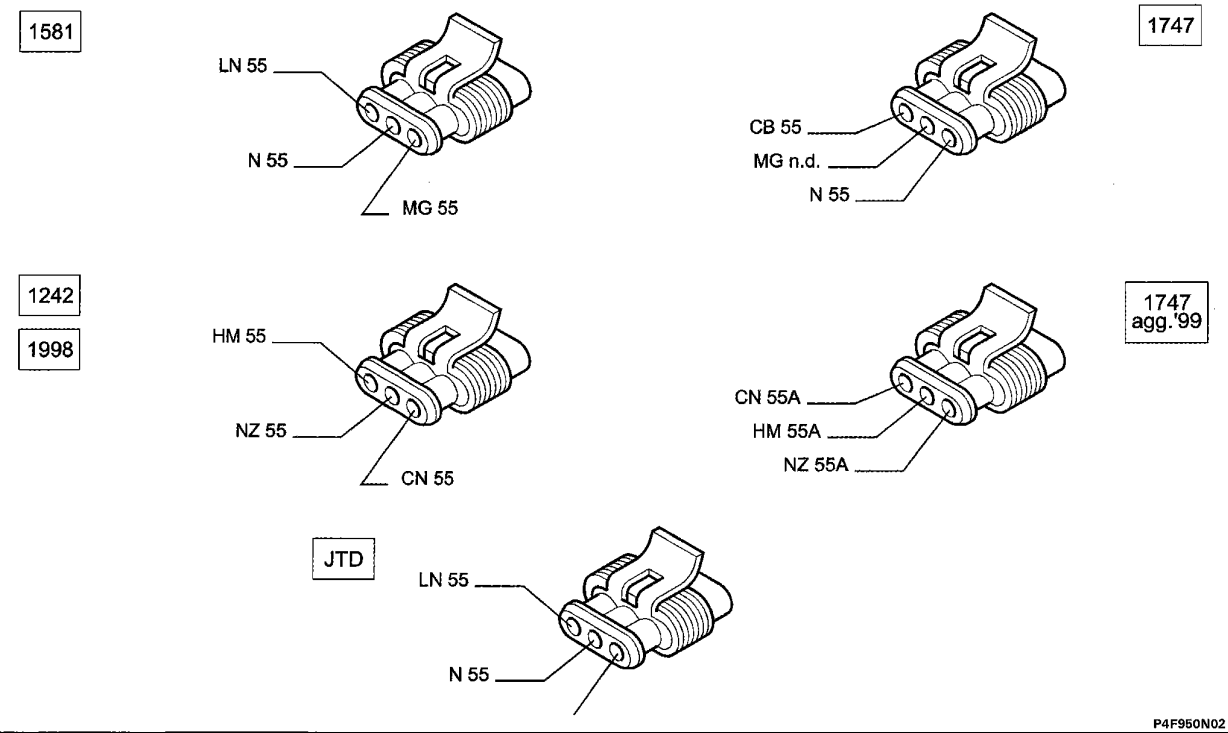
# 55.

## 136 Detonation sensor




P4F950N01

## 137 Vehicle speed sensor

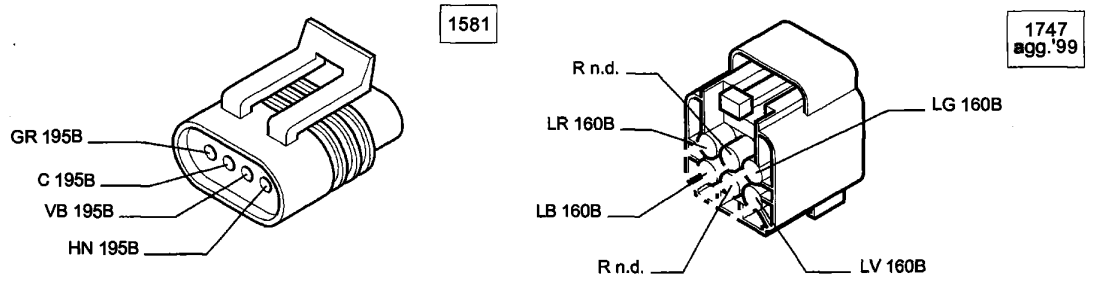



P4F950N02



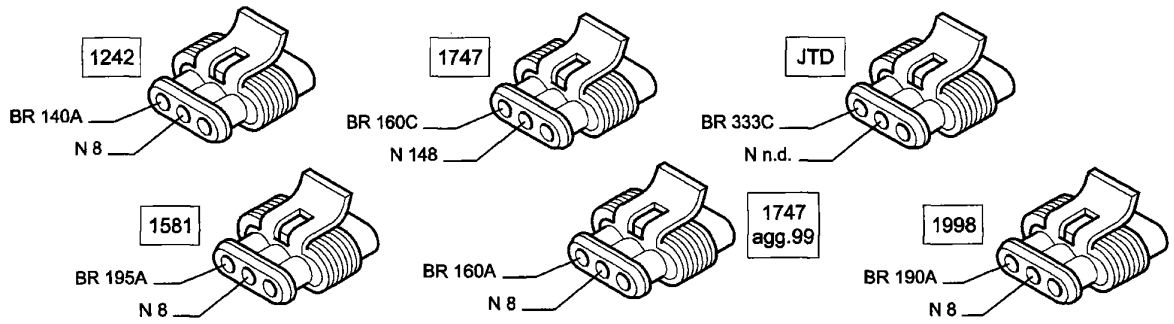

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## 138 Idie adjustment actuator




P4F951N01

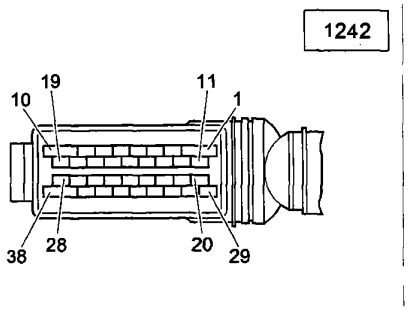
## 139 Tester socket for injection system




P4F951N02

## 140A Injection/ignition control unit (1242)

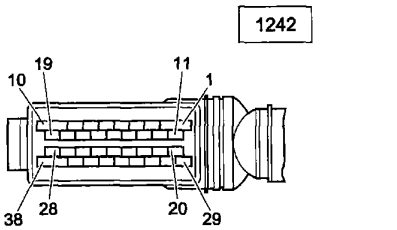
| | | | | | |
|---|---|---|---|---|---|
| 2 | L 6A | 12 | LN 6A | 27 | VB 70 ** |
| 3 | BV 151 | 13 | AG 127 | 31 | S 127 |
| 4 | AB 127 | 16 | GV 131 | 34 | B 127 |
| 7 | SR n.d. | 17 | HR n.d. | 35 | BN 127 |
| 8 | C n.d. | 18 | RV n.d. | | |
| 9 | G 150 | 19 | MG 127 | | |
| 10 | M 371 | 22 | R 55 | | |
| 11 | BR 139 | 27 | VB 6A * | | |




P4F951N05

## 140B Injection/ignition control unit (1242)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | N n.d. | 9 | N n.d. | 21 | B 141 | 35 | RN 372 |
| 2 | Z 136 | 10 | CN n.d. | 22 | R 144 | 38 | GV n.d. |
| 3 | S 373 | 11 | L 136 | 26 | RV 372 | | |
| 4 | C 372 | 12 | M 373 | 28 | GV n.d. | | |
| 5 | H 334 | 13 | Z 372 | 29 | RB n.d. | | |
| 6 | BR 194 | 16 | BV 194 | 30 | V 141 | | |
| 7 | BL 194 | 17 | BN 194 | 32 | B 144 | | |
| 8 | RG 141 | 19 | CB n.d. | 34 | NZ 132 | | |




P4F951N04

(*) from Nov. 99

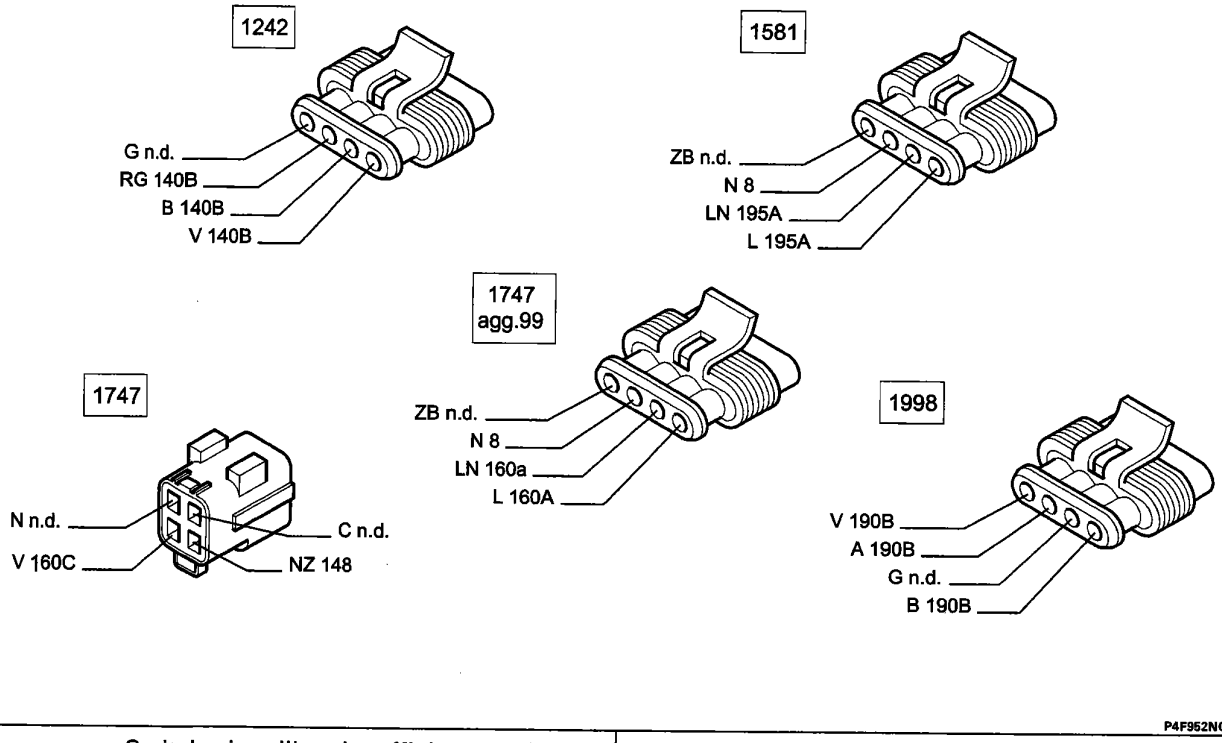
(**) up to Nov. 99



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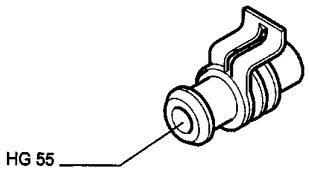
# 55.

## 141 Heated Lambda sensor



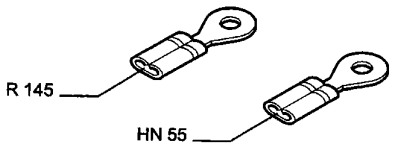

P4F952N01

## 142 Switch signalling insufficient engine oil pressure




P4F952N02

## 143 Alternator

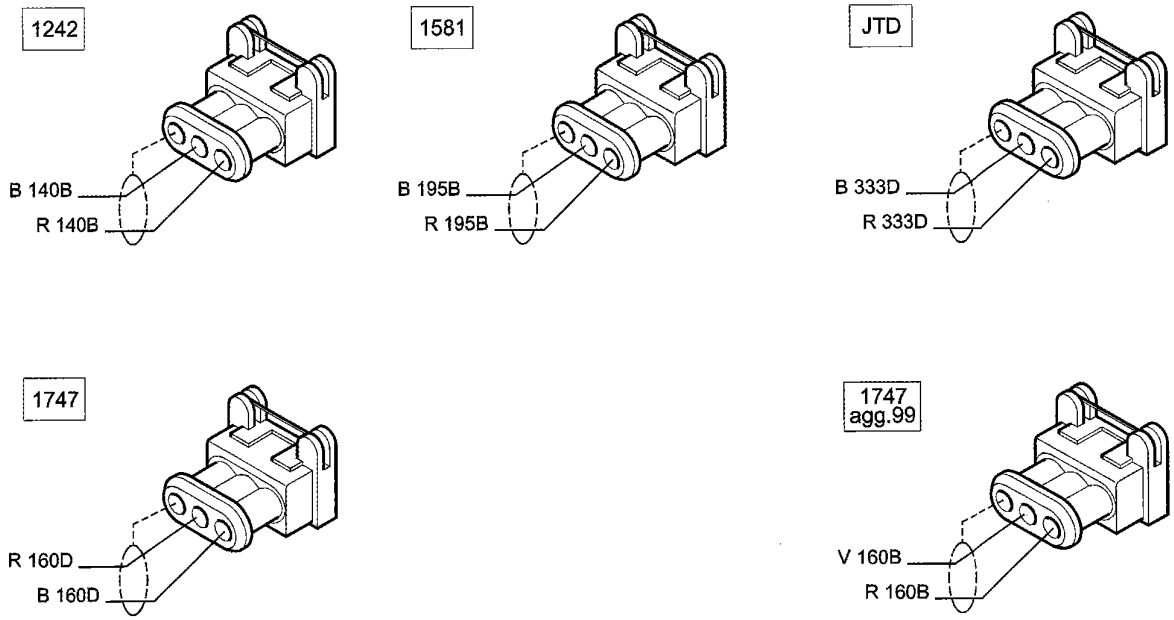



P4F952N03



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## 144 RPM and TDC sensor



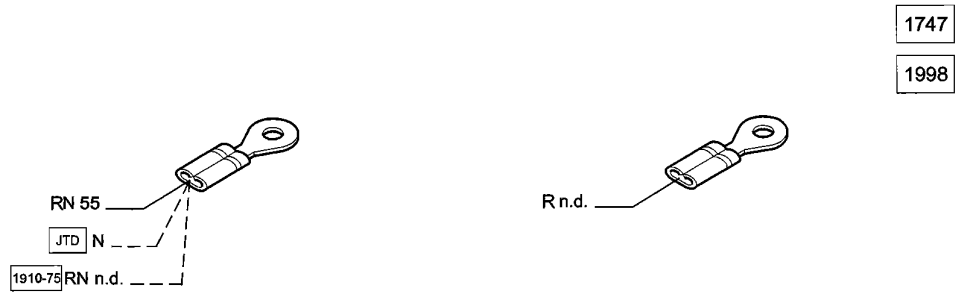

P4F953N01

## 145 Starter motor




P4F953N02

## 145A Starter motor



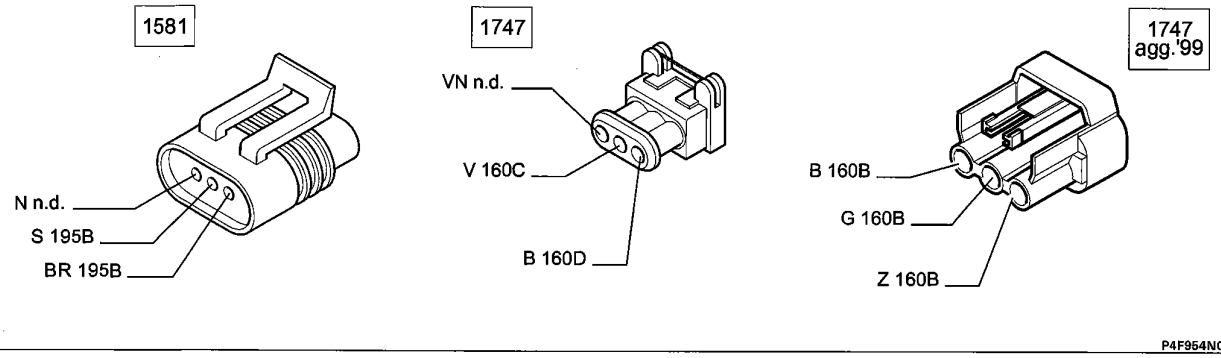

P4F953N03



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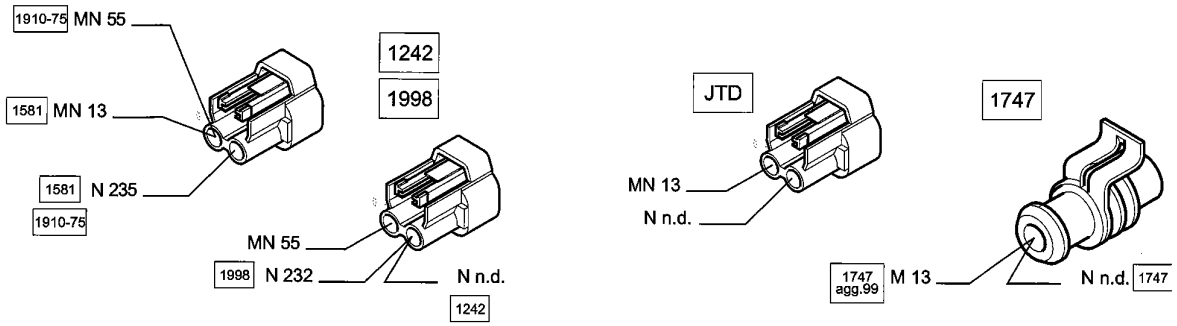
# 55.

## 146 Potentiometer on butterfly valve



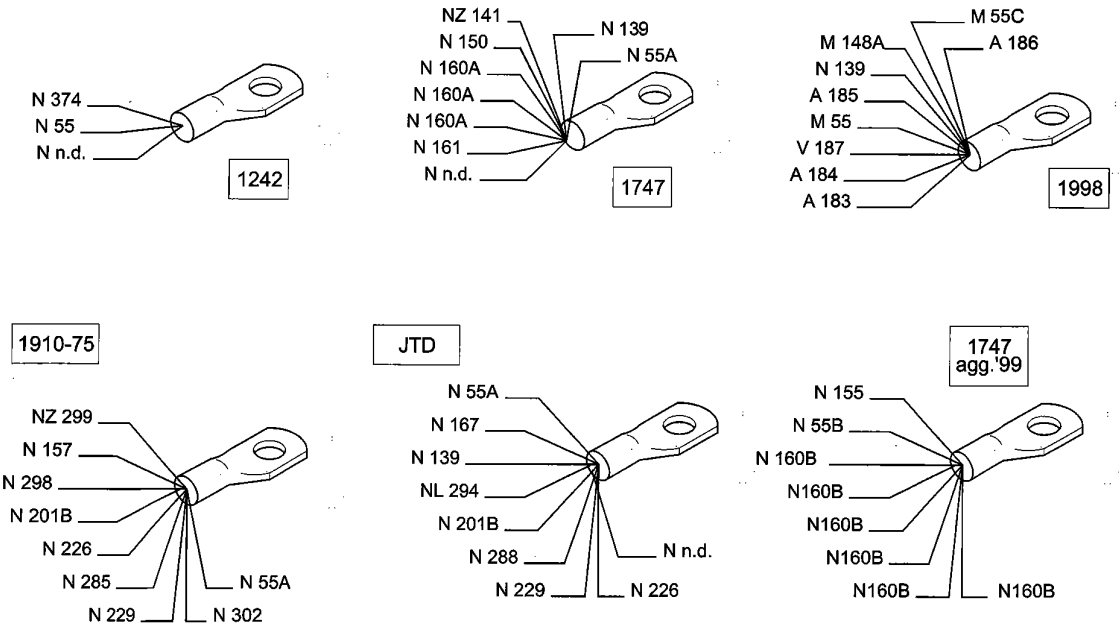

P4F954N01

## 147 Compressor for air conditioning




P4F954N02

## 148 Earth for electronic injection

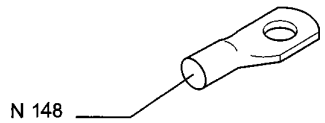



P4F954N03




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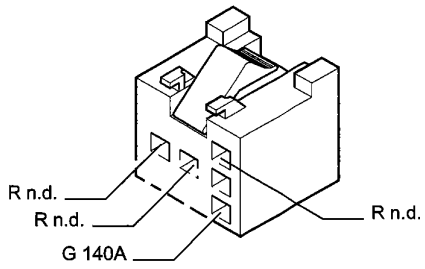
## 148A Earth for electronic injection




P4F955N01

## 150 Injection system relay feed

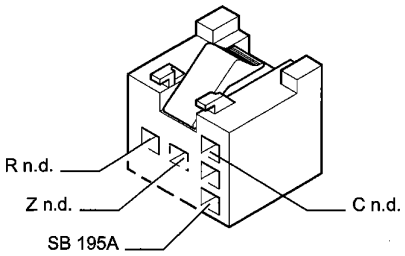
1242




P4F955N02

## 150 Injection system relay feed

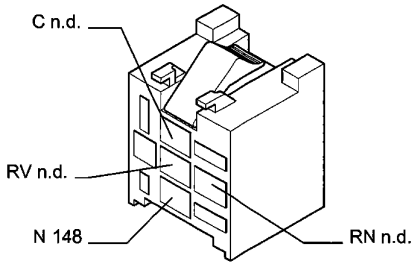
1581




P4F955N03

## 150 Injection system relay feed

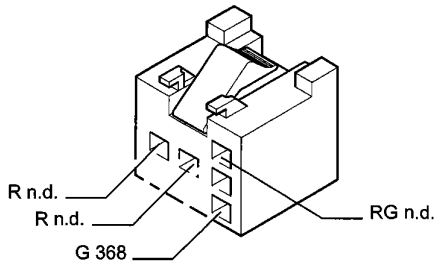
1747




P4F955N04

## 150 Injection system relay feed

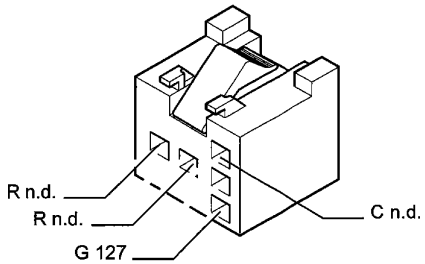
1747 agg.'99




P4F955N05

## 150 Injection system relay feed

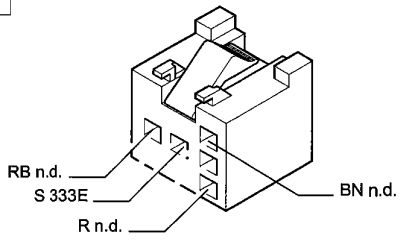
1998




P4F955N06

## 150 Injection system relay feed

JTD

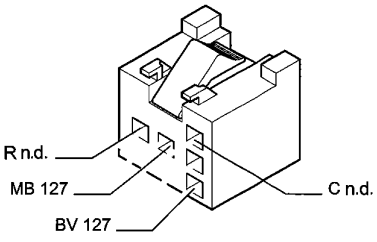



P4F955N07

## 151 Relay for Lambda sensor, electric fuel pump, injectors

1747 agg.'99

1998




P4F955N08

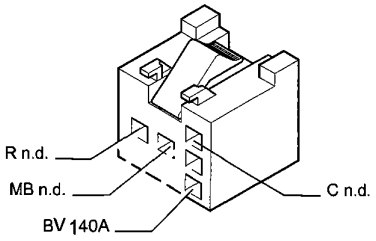


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# 55.

**151** Relay for Lambda sensor, electric fuel pump, injectors

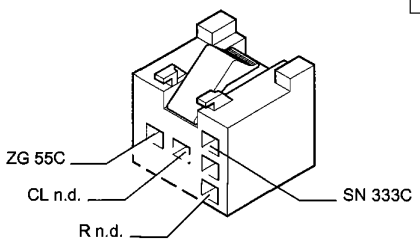
1242




P4F956N01

**151** Relay for Lambda sensor, electric fuel pump, injectors

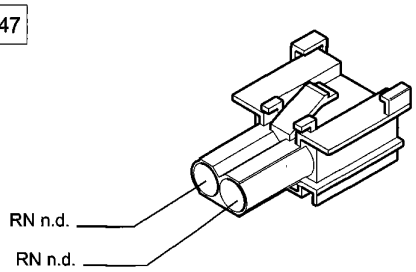
JTD




P4F956N02

**152** Injection system protective fuse

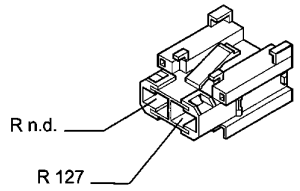
1747




P4F956N03

**152** Injection system protective fuse

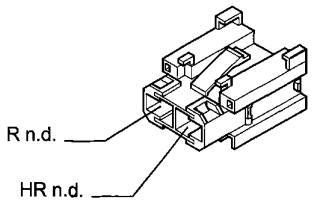
JTD




P4F956N04

**152A** Injection system protective fuse

1242

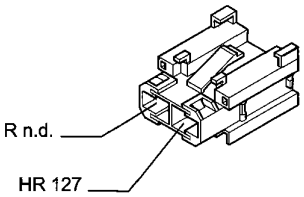



P4F956N05

**152A** Injection system protective fuse

1747 agg.'99

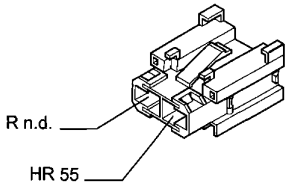
1998




P4F956N06

**152B** Injection system protective fuse

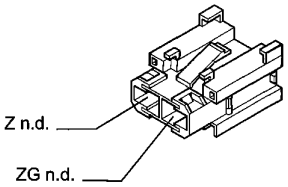
1242




P4F956N07

**152B** Injection system protective fuse

1581



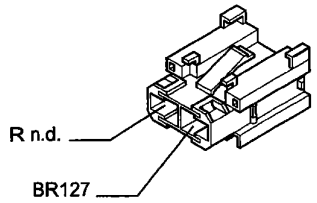

P4F956N08




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## 152B Fuse protecting injection system

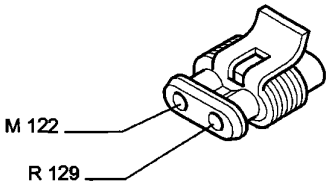
1747 agg.'99
1998




P4F957N01

## 154 Engine cooling fan

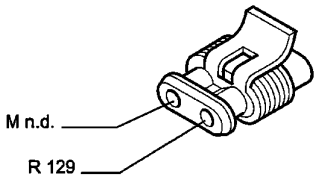
1747 agg.'99
1747
1998
1242
1581




P4F957N02

## 154 Engine cooling fan

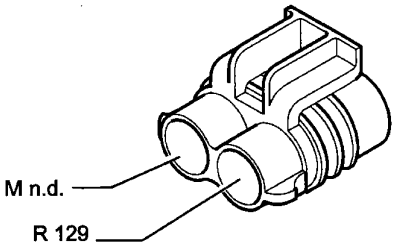
1242
1581




P4F957N03

## 154 Engine cooling fan

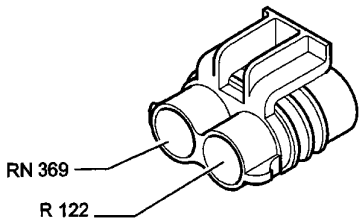
1910-JTD




P4F957N04

## 154A

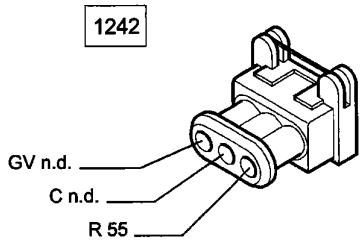
1910-JTD




P4F957N05

## 155 Ignition coil unit

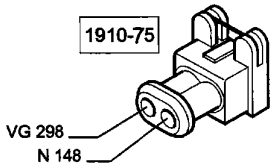
1242



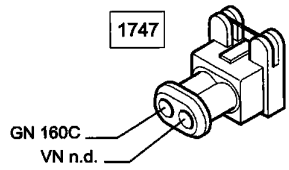

P4F957N06

## 157 Coolant temperature sensor for injection system

1910-75




1747




P4F957N07

*Copyright Fiat Auto*



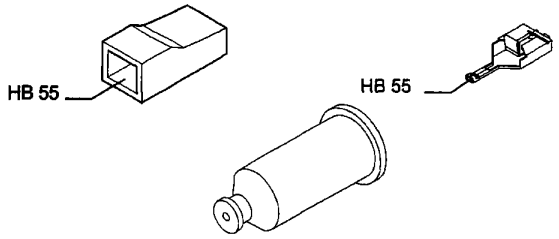
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# 55.

## 158 Coolant temperature sensor for sensor

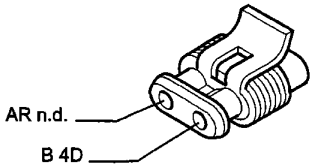
1747

1910-75




P4F958N01

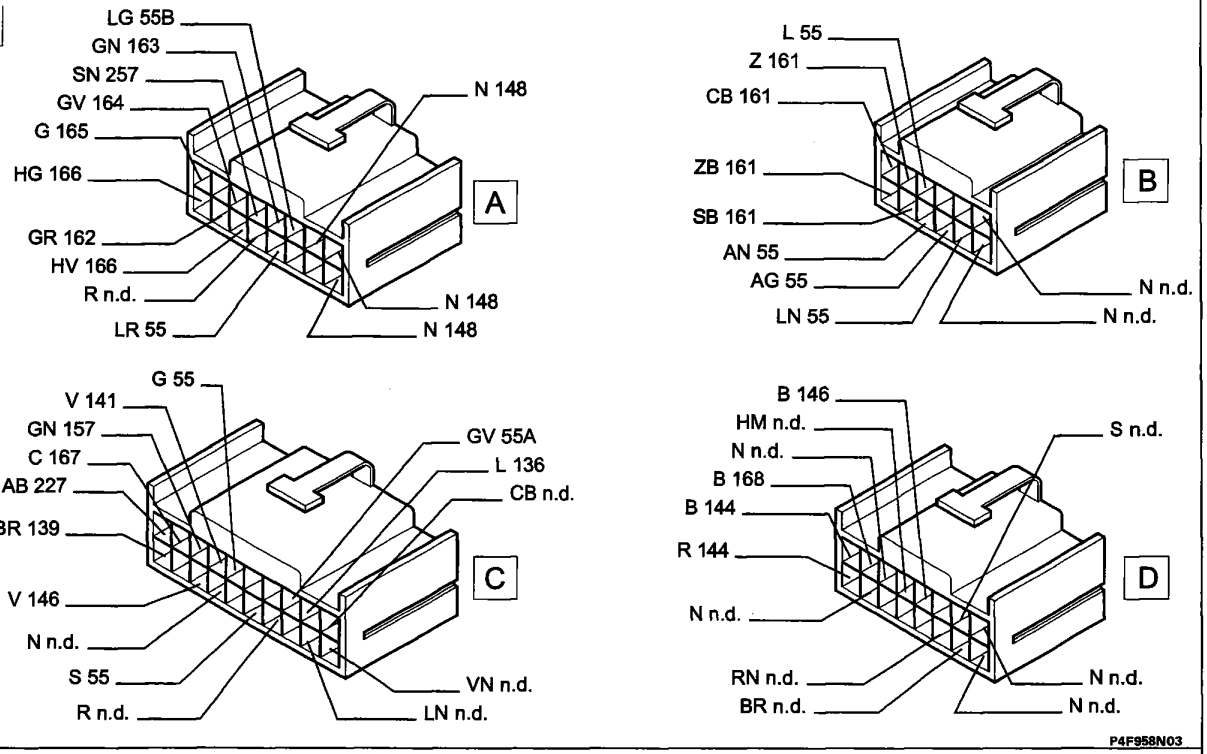
## 159 Reversing lights control switch




P4F958N02

## 160 Injection/ignition electronic control unit (1747)

1747

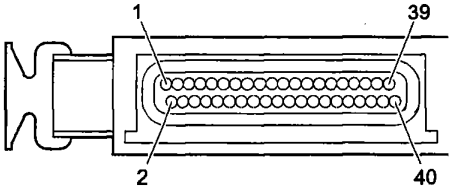



P4F958N03

## 160A Injection/ignition electronic control unit (1747)

1747 agg.99

| | | |
|---|---|---|
| 1 GL 127 | 9 S 127 | 21 LN 141 |
| 2 C n.d. | 10 MG 127 | 26 N 127 |
| 3 BM n.d. | 14 AG 127 | 27 B 127 |
| 4 BL n.d. | 15 AV 127 | 28 BN 127 |
| 6 RZ n.d. | 17 L 6A | 30 GV 131 |
| 6 RV n.d. | 18 VB 70 ** | 31 M 371 |
| 7 BG 127 | 18 VB 6A * | 32 BR 139 |
| 8 LN 6A | 20 L 141 | |




P4F958N05

(*) from Nov. 99

(**) up to Nov. 99

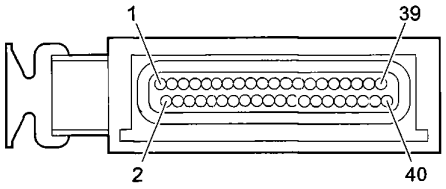



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## 160B Injection/ignition electronic control unit (1747)

1747 agg.99

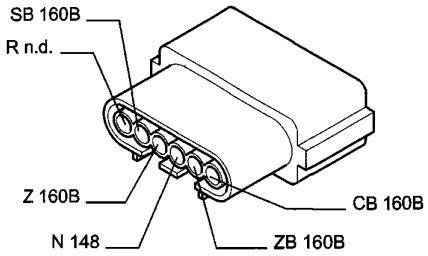
| | | | |
|---|---|---|---|
| 1 GR 162 | 10 CB 155 | 20 B n.d. | 31 B n.d. |
| 2 GN 163 | 11 B 334 | 21 N n.d. | 35 N n.d. |
| 3 GV 164 | 12 B n.d. | 22 L 168 | 37 LG 138 |
| 4 G 165 | 14 G 167 | 23 R 144 | 38 LV 138 |
| 5 N n.d. | 15 G 146 | 24 V 144 | 39 LR 138 |
| 6 N n.d. | 16 C 334 | 25 N n.d. | 40 LB 138 |
| 7 RB 155 | 17 Z 146 | 26 N n.d. | |
| 8 VB 155 | 18 B n.d. | 27 LG 132 | |
| 9 HB 155 | 19 G 136 | 28 N n.d. | |




P4F959N01

## 161 Ignition power module

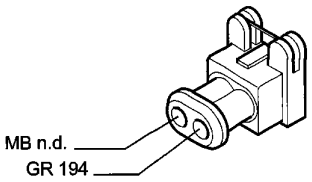
1747




P4F959N02

## 162 Injector (1)

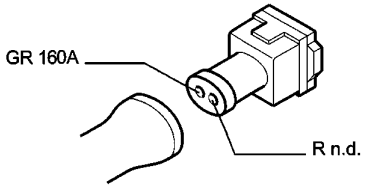
1242
1581




P4F959N03

## 162 Injector (1)

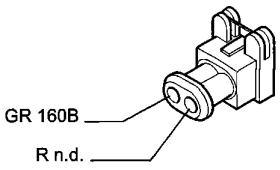
1747




P4F959N04

## 162 Injector (1)

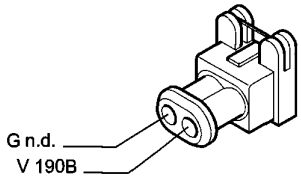
1747 agg.'99




P4F959N05

## 162 Injector (1)

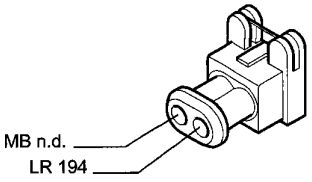
1998




P4F959N06

## 163 Injector (2)

1242
1581




P4F959N07

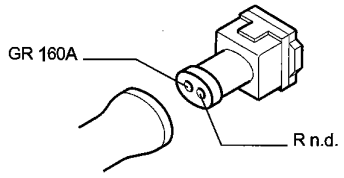


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# 55.

**163** Injector (2)

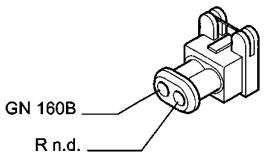
1747




P4F960N01

**163** Injector (2)

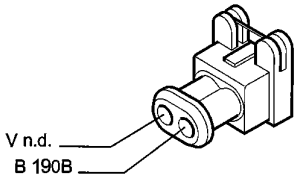
1747 agg.'99




P4F960N02

**163** Injector (2)

1998

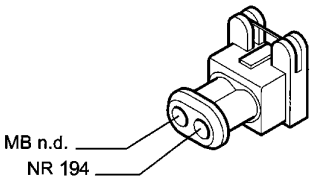



P4F960N03

**164** Injector (3)

1242

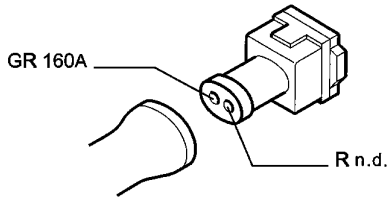
1581




P4F960N04

**164** Injector (3)

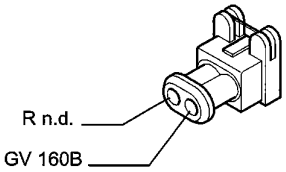
1747




P4F960N05

**164** Injector (3)

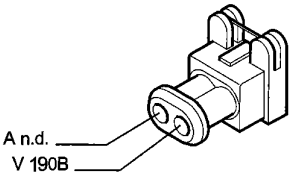
1747 agg.'99




P4F960N06

**164** Injector (3)

1998

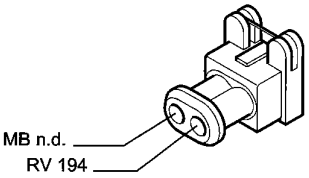



P4F960N07

**165** Injector (4)

1242

1581



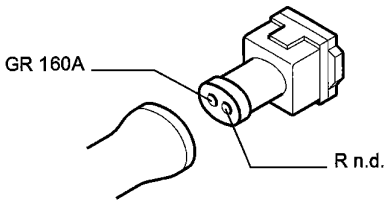

P4F960N08




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## 165 Injector (4)

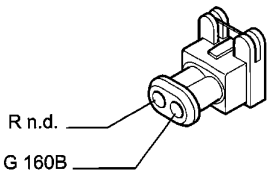
1747




P4F961N01

## 165 Injector (4)

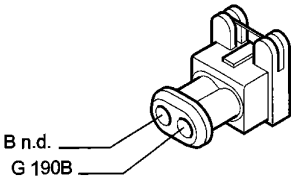
1747 agg.'99




P4F961N02

## 165 Injector (4)

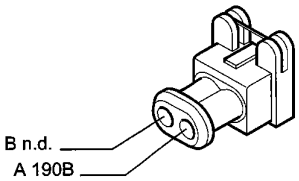
1998




P4F961N03

## 165A Injector (5) (1998)

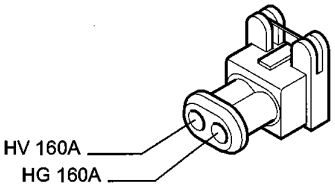
1998




P4F961N04

## 166 Idle adjustment actuator

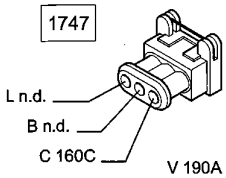
1747



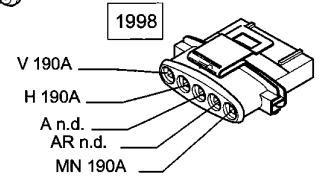

P4F961N05

## 167 Air flow meter

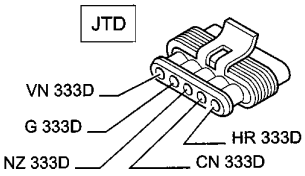
1747



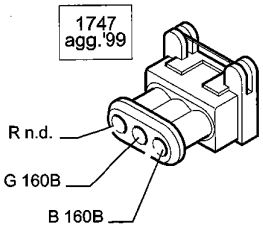

1998




JTD




1747 agg.'99



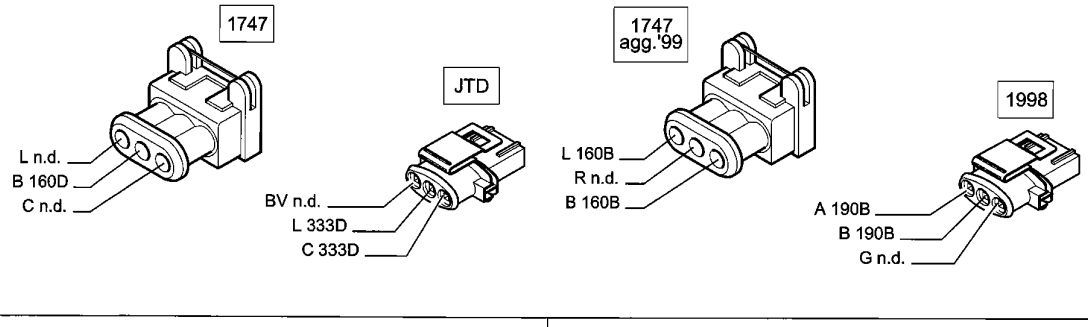

P4F961N06



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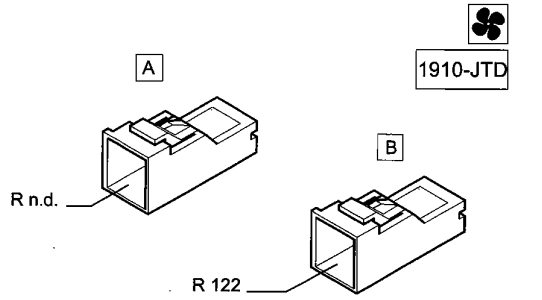
# 55.

## 168 Timing sensor



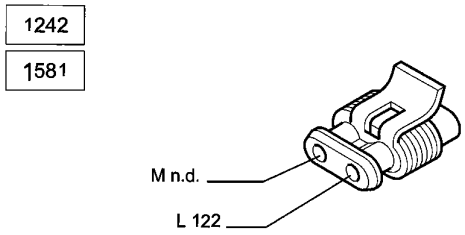

P4F962N01

## 170 Engine cooling fan resistor



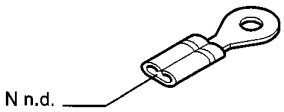

P4F962N02

## 170 Engine cooling fan resistor



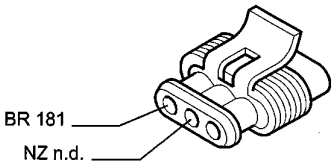

P4F962N03

## 174 Power earth for A.B.S.



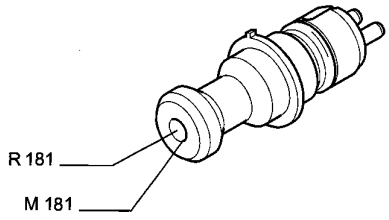

P4F962N04

## 176 Diagnostic socket for A.B.S.



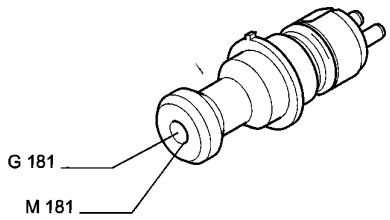

P4F962N05

## 177 Sensor on left front wheel for A.B.S.




P4F962N06

## 178 Sensor on left rear wheel for A.B.S.

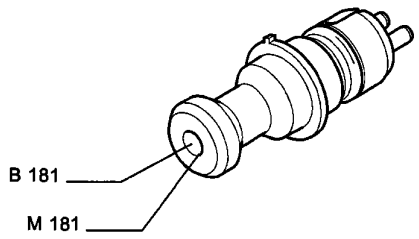



P4F962N07



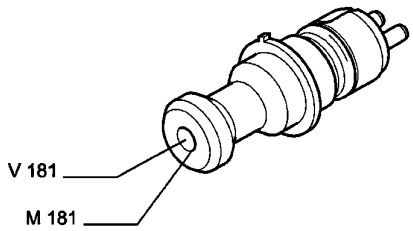

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## 179 Sensor on right front wheel (A.B.S.)




P4F963N01

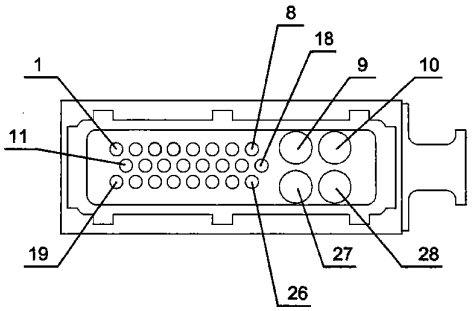
## 180 Sensor on right rear wheel (A.B.S.)




P4F963N02

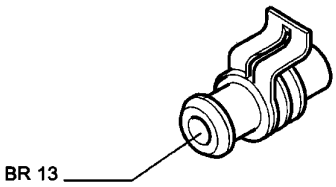
## 181 ABS hydraulic control unit

| | | | |
|---|---|---|---|
| 9 | M 180 | 18 | R n.d. |
| 10 | V 180 | 19 | N n.d. |
| 11 | BR 176 | 20 | RV 95 |
| 12 | M 179 | 21 | BN 95 |
| 13 | B 179 | 22 | M 178 |
| 14 | M 177 | 23 | G 178 |
| 15 | C 95 | 24 | LR 95 |
| 16 | N n.d. | 25 | R 177 |
| 17 | R n.d. | | |




P4F963N03

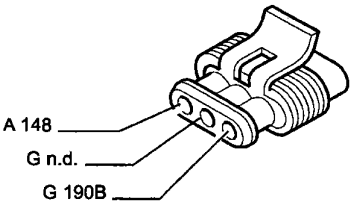
## 182A Right brake pad wear sensor cable connection




P4F963N04

## 183 Ignition coil (1°)

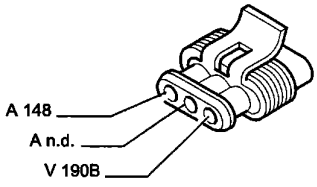
1998




P4F963N05

## 184 Ignition coil (2°)

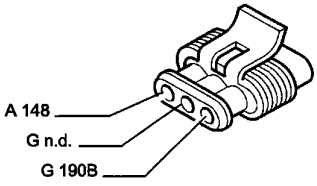
1998




P4F963N06

## 185 Ignition coil (3°)

1998




P4F963N07

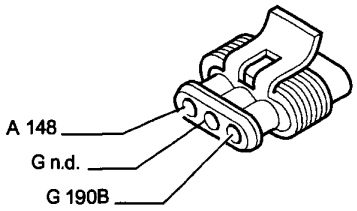


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# 55.

## 186 Ignition coil (4°)

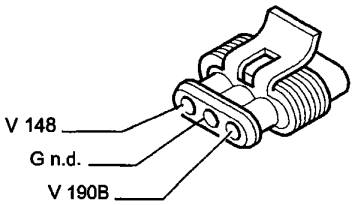
1998




P4F964N01

## 187 Ignition coil (5°) (1998)

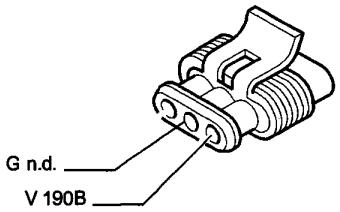
1998




P4F964N02

## 189 Variable valve timing

1998

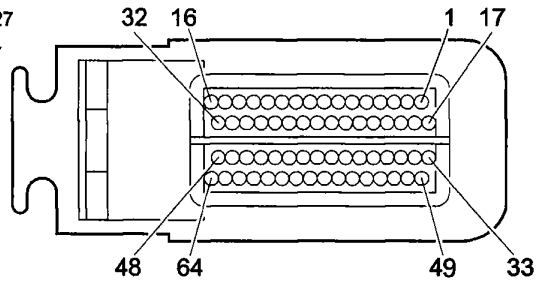



P4F964N03

## 190A Injection/ignition electronic control unit (1998)

1998

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 3 | GV 131 | 25 | A n.d | 44 | VB 6A * | 59 | SB 292 |
| 6 | S 127 | 27 | RN n.d. | 46 | LN 6A | 62 | AB 127 |
| 7 | AN 291 | 30 | BG 127 | 47 | C n.d | 63 | H 167 |
| 8 | GN 291 | 31 | G 127 | 48 | BV n.d | | |
| 9 | B 127 | 32 | BV n.d | 50 | AG 127 | | |
| 13 | MG 127 | 35 | L 6A | 53 | BR 139 | | |
| 15 | RV n.d. | 40 | HB 291 | 54 | MN 167 | | |
| 16 | BV n.d | 41 | BN 127 | 56 | ZN 291 | | |
| 24 | ZB 291 | 44 | VB 70 ** | 57 | V 167 | | |

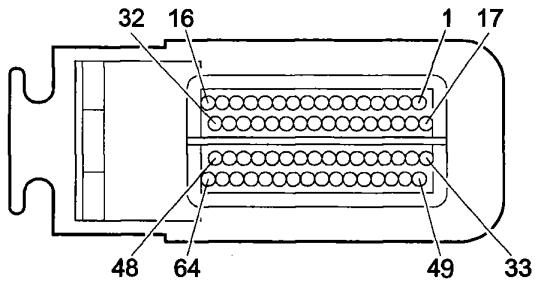



P4F964N06

## 190B Injection/ignition electronic control unit (1998)

1998

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | G n.d. | 18 | V 162 | 34 | B n.d. | 55 | A 141 |
| 3 | G 165 | 20 | V 164 | 35 | B 163 | 58 | A 364 |
| 4 | G 189 | 22 | V 136 | 36 | B 363 | 59 | A 223 |
| 5 | G 132 | 23 | V 141 | 38 | B 136A | | |
| 6 | G 136A | 24 | V 64 | 40 | B 364 | | |
| 10 | G 223 | 25 | V 334 | 42 | B 168 | | |
| 14 | G 185 | 26 | V n.d. | 49 | A n.d. | | |
| 15 | G 186 | 31 | V 187 | 51 | A 168 | | |
| 16 | G 183 | 32 | V 184 | 52 | A 165A | | |
| 17 | V n.d. | 33 | B n.d. | 54 | A 136 | | |




P4F964N05

(*) from Nov. 99

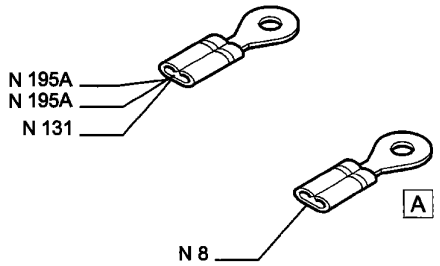
(**) up to Nov. 99




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## 193 Earth for electronic injection

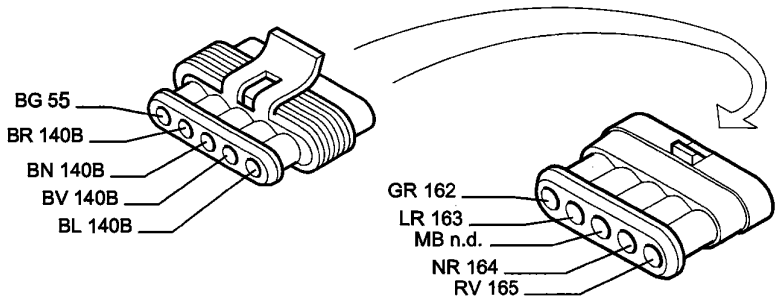
1581




P4F965N01

## 194 Injection/injector braid lead connection

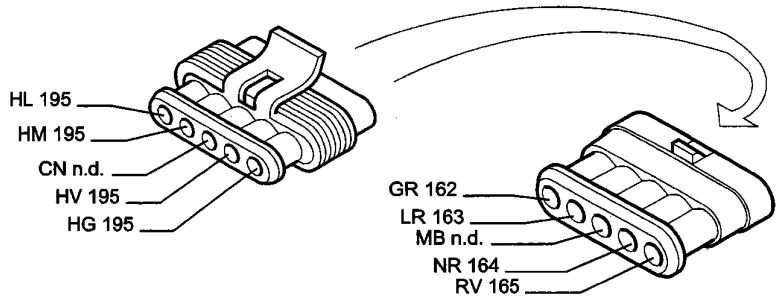
1242




P4F965N02

## 194 Injection/injector braid lead connection

1581

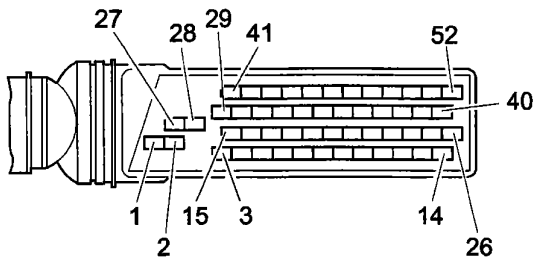



P4F965N03

## 195A Ignition / injection control unit. (1581)

1581

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4 | L 6A | | 26 | LN 6A | | 48 | S 127 |
| 5 | V 252 | ☐ | 27 | N 193 | | 49 | NZ 252 ☐ |
| 9 | LN 141 | | 28 | N 193 | | 50 | VB 70 ** |
| 13 | GV 131 | | 29 | RN n.d. | | 50 | VB 6A * |
| 14 | AB 127 | | 35 | B 127 | | 52 | RG 13 |
| 15 | SB 150 | | 36 | LR 252 | ☐ | | |
| 16 | GN 252 | ☐ | 40 | AG 127 | | | |
| 20 | L 141 | | 41 | MG 127 | | | |
| 21 | BN 127 | | 44 | sch 141 | | | |
| 25 | BR 139 | | 47 | C n.d. | | | |




P4F965N05

(*) from Nov. 99

(**) up to Nov. 99



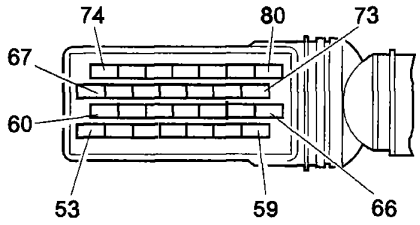
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# 55.

## 195B Ignition / injection control unit. (1581)

1581

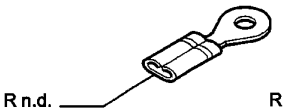
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|---|---|---|---|---|---|
| 53 | R 144 | 65 | VB 138 | 77 | NZ n.d. |
| 54 | N n.d. | 66 | LR 155 | 78 | HM 194 |
| 55 | ZB 278 | 67 | B 144 | 79 | HV 194 |
| 56 | L 136 | 68 | V 278 | | |
| 58 | HN 138 | 70 | Z 136 | | |
| 59 | GN 155 | 71 | HG 194 | | |
| 60 | S 146 | 72 | HL 194 | | |
| 62 | SN 339 | 75 | RN 278 | | |
| 64 | GR 138 | 76 | BR 146 | | |



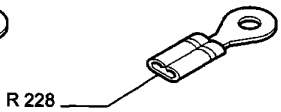

P4F966N01

## 201A Glow plug preheating control unit

1910-75




JTD

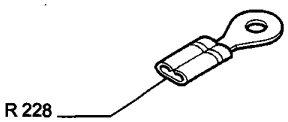



P4F966N02

## 201C Glow plug preheating control unit

1910-75

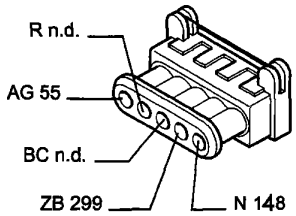
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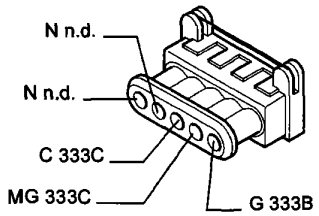

P4F966N03

## 201B Glow plug preheating control unit

1910-75

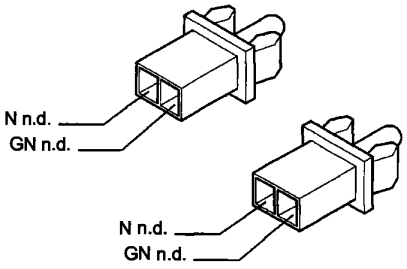



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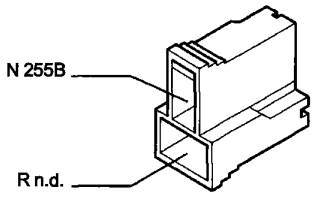

P4F966N04

## 202 Heater/air conditioning unit symbol lighting bulbs




P4F966N05

## 206 Car interior climate control fan

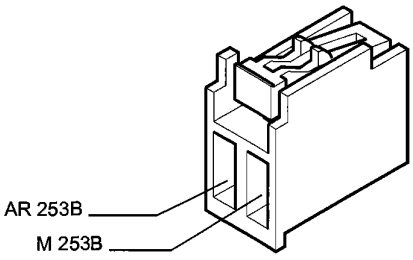



P4F966N06



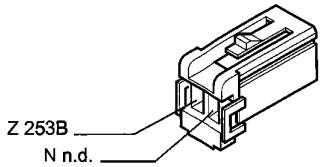

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## 209 Intake air flap control actuator



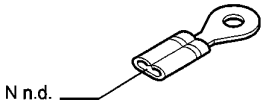

P4F967N01

## 211 Frost sensor




P4F967N02

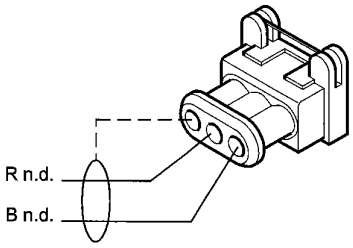
## 222 Earth for climate control system



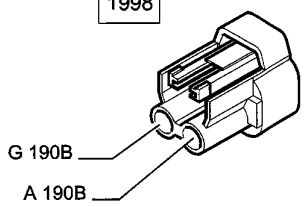

P4F967N03

## 223 Rpm sensor

1910-75



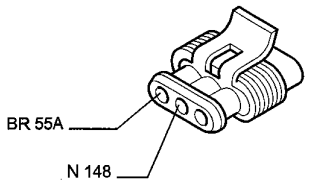

1998




P4F967N04

## 226 Diagnostic socket for FIAT CODE system (1910 TD-75)

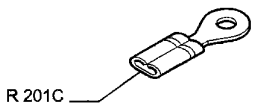
1910-75




P4F967N05

## 228 Heater plugs (TD)

JTD
1910-75



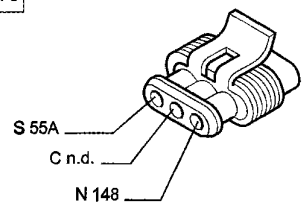

P4F967N06



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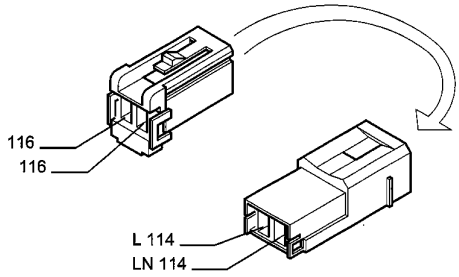
### 229 Engine cut out electrostop (TD)

1910-75




P4F968N01

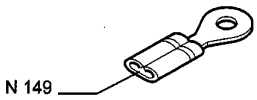
### 231 Clock spring connector




P4F968N02

### 232 Earth for compressor

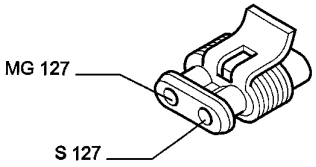
1998




P4F968N03

### 233 Thermal switch on water pump

1910-75

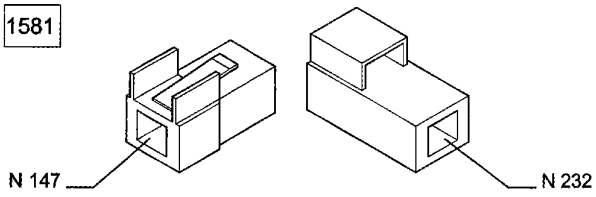



P4F968N04

### 235 Connection for air conditioning compressor cables

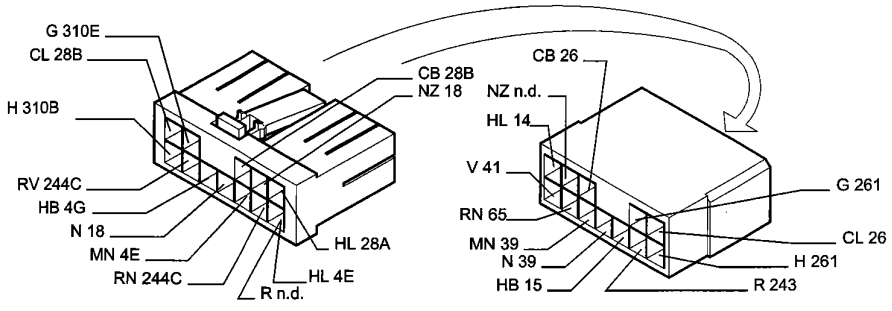
1910-75

1581




P4F968N05

### 236 Connection for rear cable with tailgate

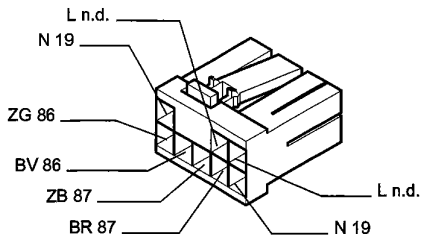



P4F968N06



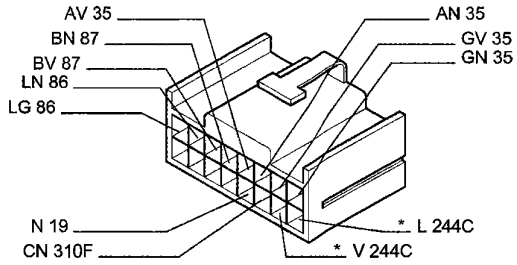

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## 238A Electric rear windows control unit



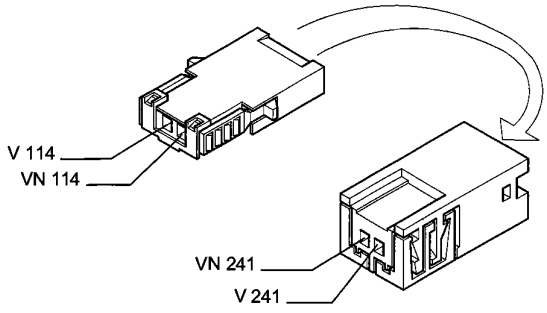

P4F969N01

## 238B Electric rear windows control unit



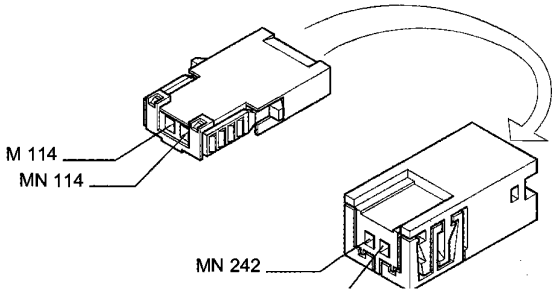

P4F969N02

## 239 Connection between Air Bag/left pre-tensioner cables



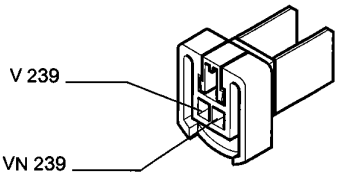

P4F969N03

## 240 Connection between Air Bag/right pre-tensioner cables



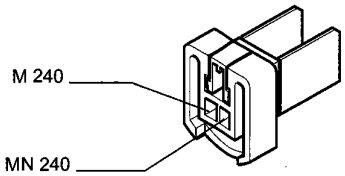

P4F969N04

## 241 Left pretensioner



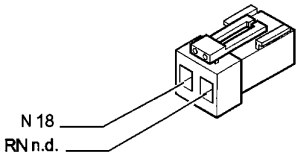

P4F969N05

## 242 Right pretensioner




P4F969N06

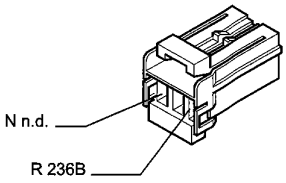
## 243 Luggage compartment light button




Marea

P4F969N07

## 243 Luggage compartment light button




Marea Weekend

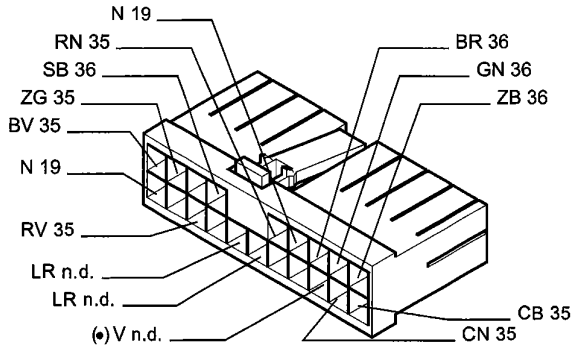
P4F969N08



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# 55.

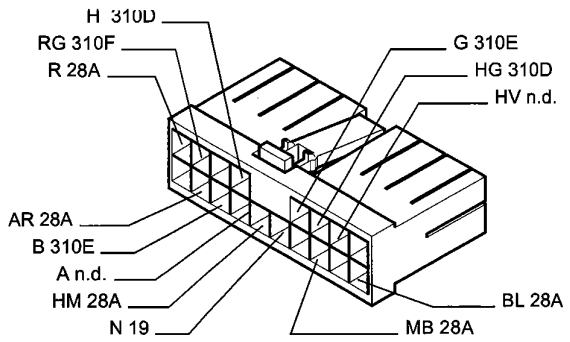
## 244A Integrated services electronic control unit




• Automatic window closing

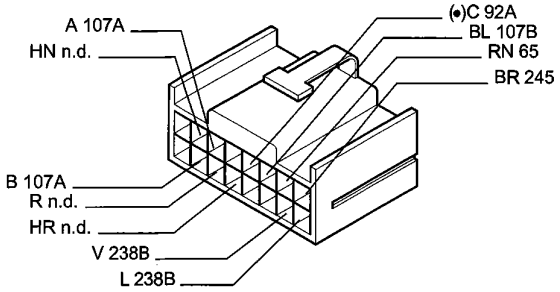
P4F970N01

## 244B Integrated services electronic control unit




P4F970N02

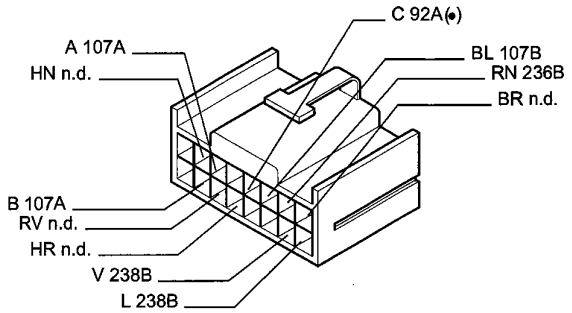
## 244C Integrated services electronic control unit




Marea • Automatic window closing

P4F970N03

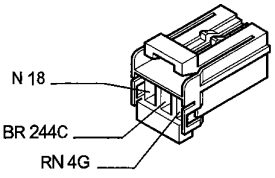
## 244C Integrated services electronic control unit




Marea Weekend • Automatic window closing

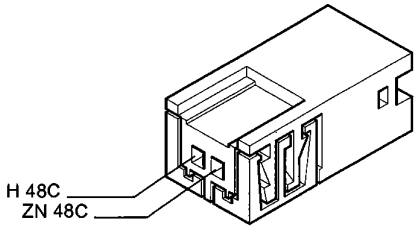
P4F970N04

## 245 Rear courtesy light



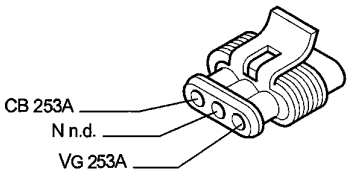

P4F970N05

## 248 Radio controls on steering wheel



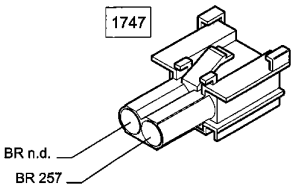

P4F970N06

## 249 Diagnostic socket for climate control system




P4F970N07

## 250 Fuel pump protective fuse

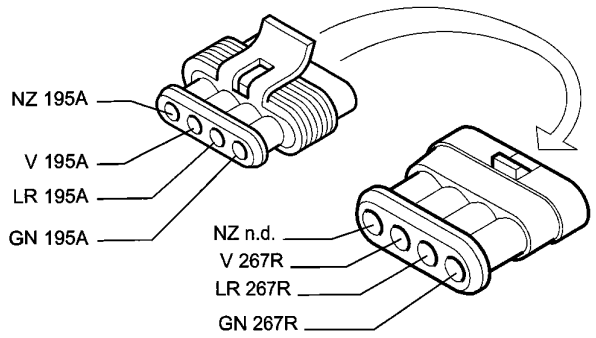



P4F970N08



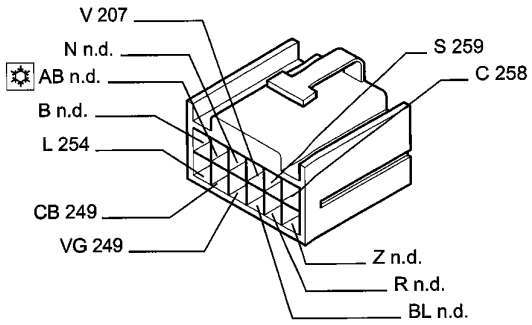

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## 252 Connection between automatic transmission/engine cables



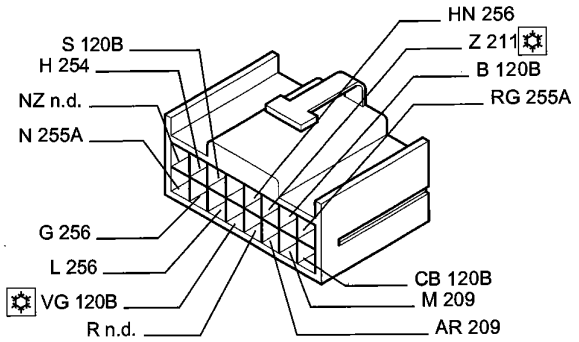

P4F971N01

## 253A Climate control unit



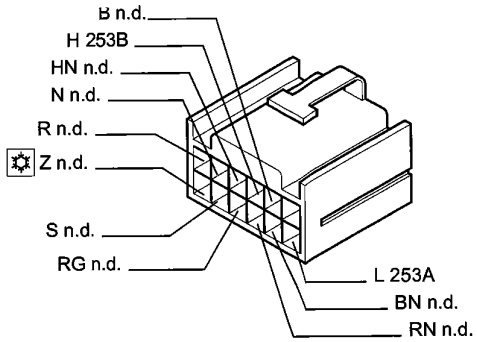

P4F971N02

## 253B Climate control unit



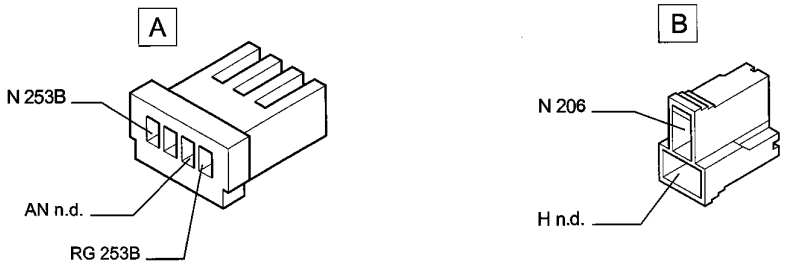

P4F971N03

## 254 Climate control controls with passenger compartment temperature sensor



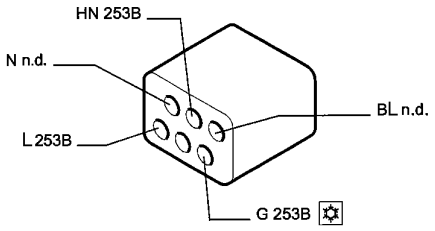

P4F971N04

## 255 Electronic speed transformer for climate control fan



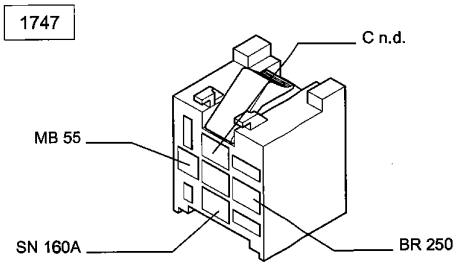

P4F971N05

## 256 Mixing air control actuator




P4F971N06

## 257 Fuel pump relay feed



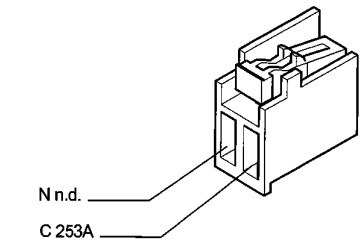

P4F971N07

*Copyright Fiat Auto*



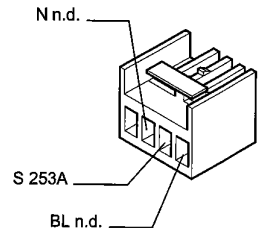
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### 258 Treated air temperature sensor



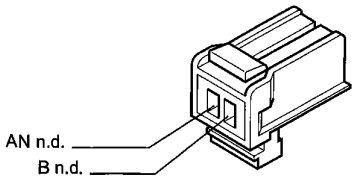

P4F972N01

### 259 Temperature adjustment switch



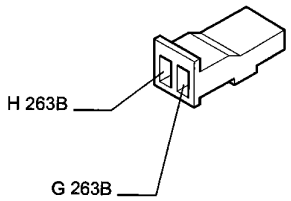

P4F972N02

### 260 MAX-DEF microswitch



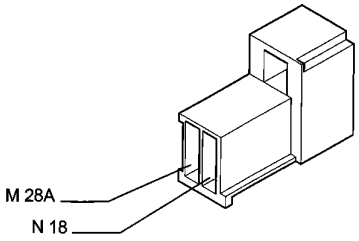

P4F972N03

### 261 Tailgate locking/unlocking actuator



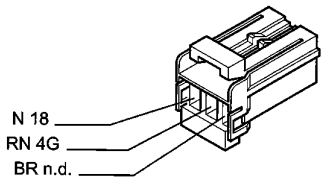

P4F972N04

### 262 Seat belts warning light switch




P4F972N05

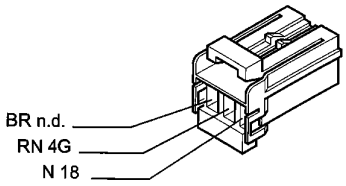
### 264 Left rear courtesy light




Marea Weekend

P4F972N06

### 265 Right rear courtesy light

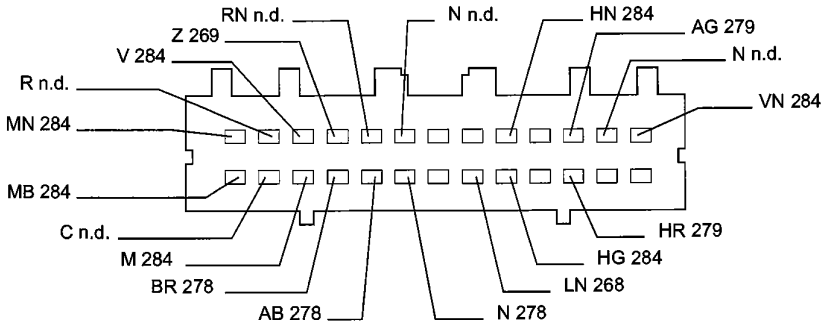



P4F972N07



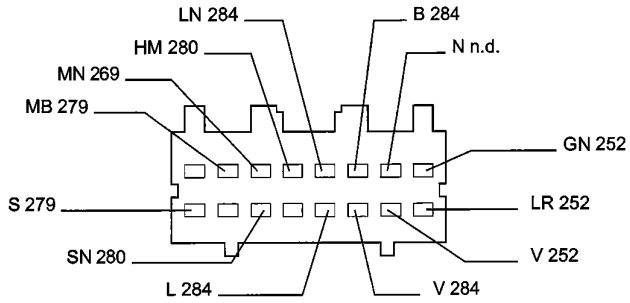

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## 267L Automatic transmission control unit



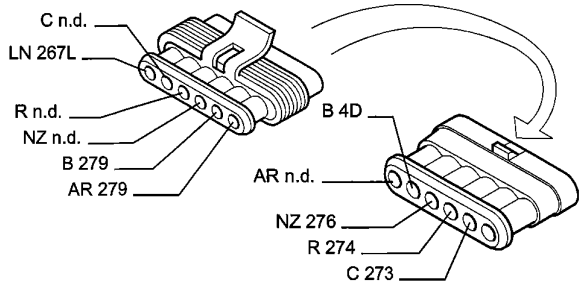

P4F973N01

## 267R Automatic transmission control unit



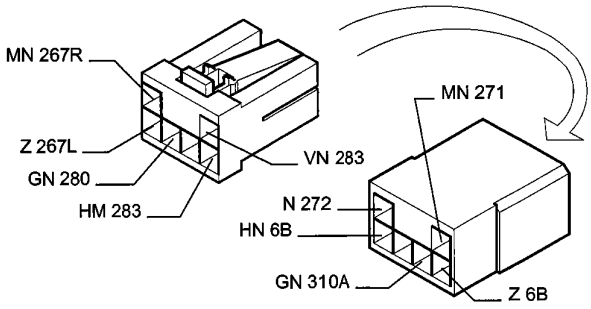

P4F973N02

## 268 Connection between automatic transmission/front cables



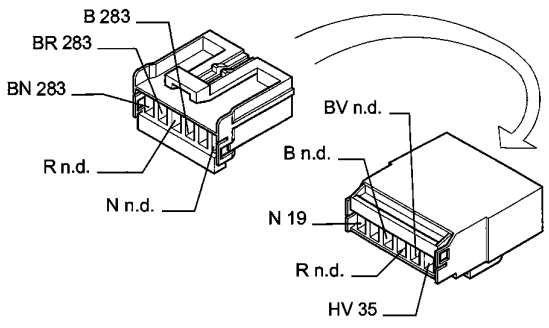

P4F973N03

## 269 Connection between automatic transmission/dashboard cables



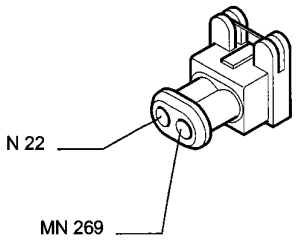

P4F973N04

## 270 Connection between automatic transmission/rear cables




P4F959N05

## 271 Kick-down switch

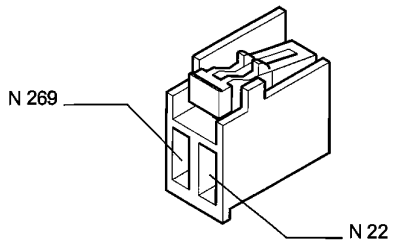



P4F959N06



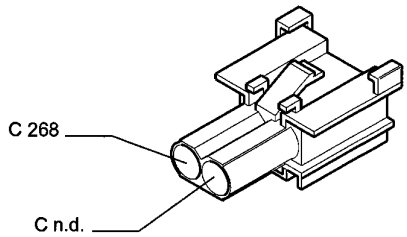
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### 272 Ignition switch electro-magnet



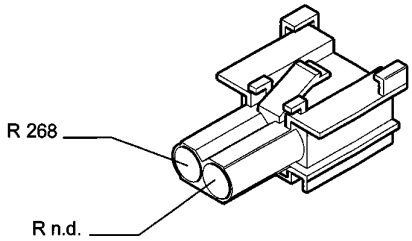

P4F974N01

### 273 Automatic transmission system protective fuse



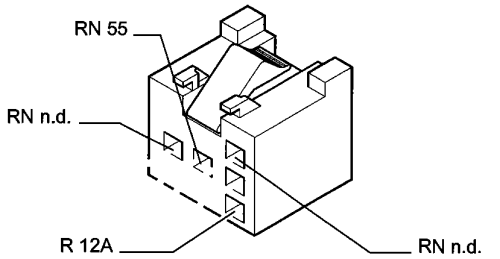

P4F974N02

### 274 Automatic transmission system protective fuse



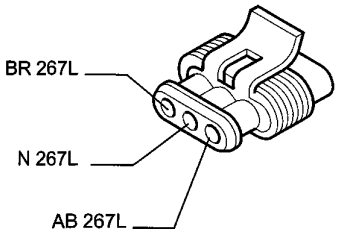

P4F974N03

### 276 Starting go ahead relay



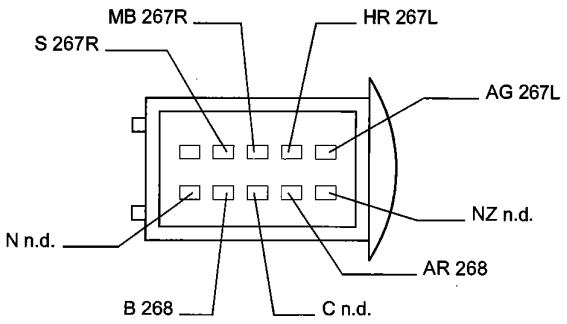

P4F974N04

### 278 Diagnostic socket for automatic transmission



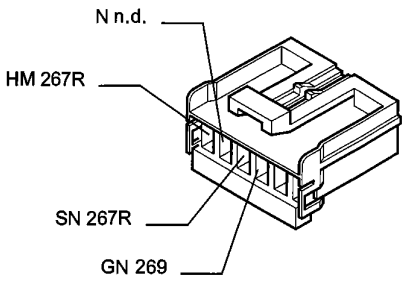

P4F974N05

### 279 Automatic transmission gear selector



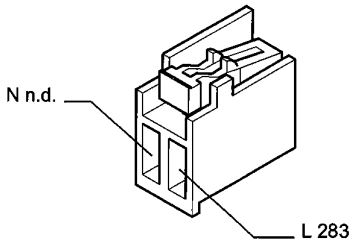

P4F974N06

### 280 ICE/SPORT selector for automatic transmission




P4F974N07

### 281 Shift Lock solenoid

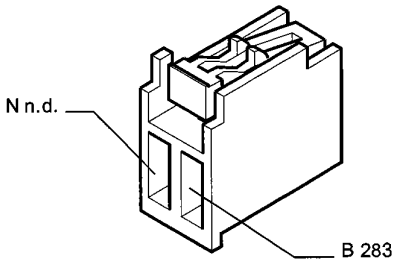



P4F974N08



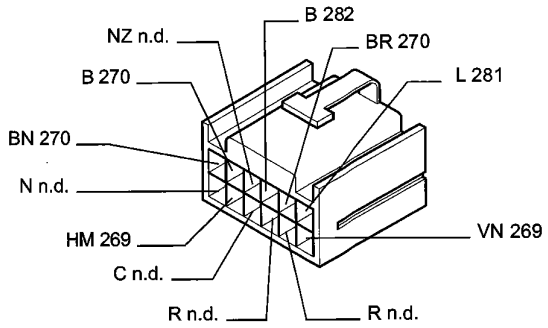

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## 282 PARK additional interruption for automatic transmission



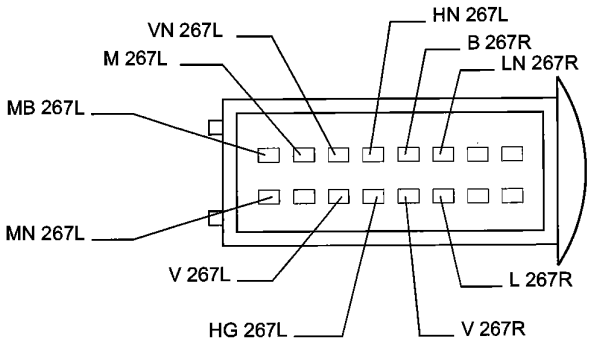

P4F975N01

## 283 Safety control unit for automatic transmission




P4F975N02

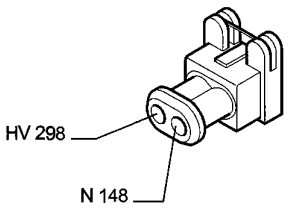
## 284 Connection for automatic transmission on gearbox



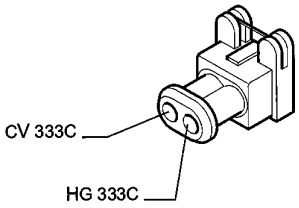

P4F975N03

## 285 EGR device control solenoid

1910-75



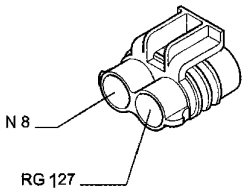

JTD




P4F975N04

## 289 Thermal contact (PCT)

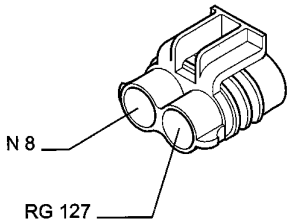
JTD




P4F975N05

## 290 Heater resistor (PCT)

JTD




P4F975N06



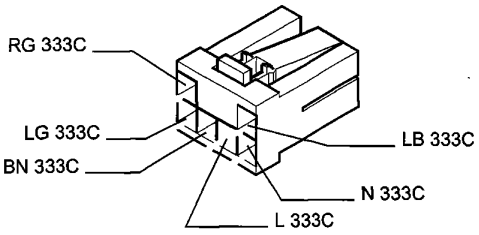
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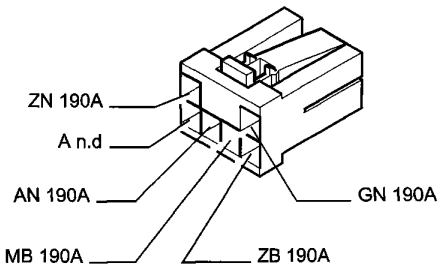
# 55.

## 291 Potentiometer on accelerator pedal

JTD

1998



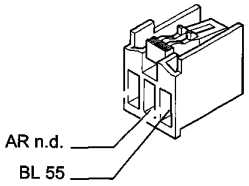



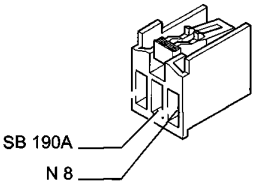

P4F976N01

## 292 Clutch pedal switch

JTD

1998

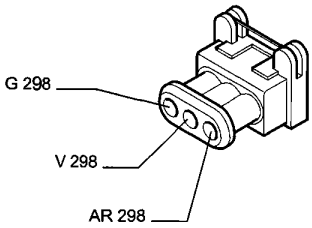



P4F976N02

## 296 Accelerator control lever potentiometer

1910-75

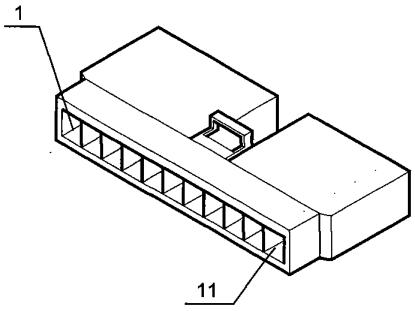



P4F976N03

## 298 E.G.R. electronic control unit (1910TD-75)

1910-75

| | | | |
|---|---|---|---|
| 1 | R n.d. | 7 | C n.d. |
| 2 | B n.d. | 8 | AR 296 |
| 3 | BR 229 | 9 | N 148 |
| 4 | VG 157 | 10 | MG 55 |
| 5 | V 296 | 11 | HV 285 |
| 6 | G 296 | | |



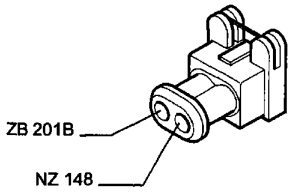

P4F976N04




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## 299 Coolant temperature sensor (preheating) (1910TD-75)

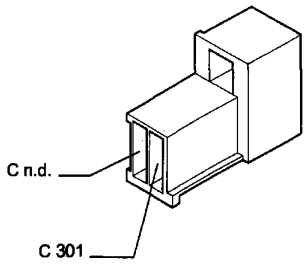
1910-75




P4F977N01

## 300 Thermal switch K.S.B. (1910TD-75)

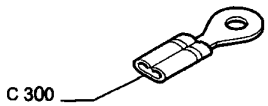
1910-75




P4F977N02

## 301 KSB device (1910TD-75)

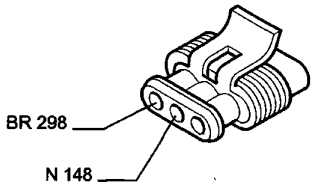
1910-75




P4F977N03

## 302 Tester point for EGR system (1910TD-75)

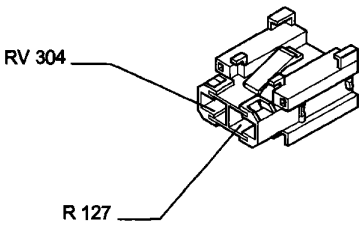
1910-75




P4F977N04

## 303 Fuse protecting diesel preheating

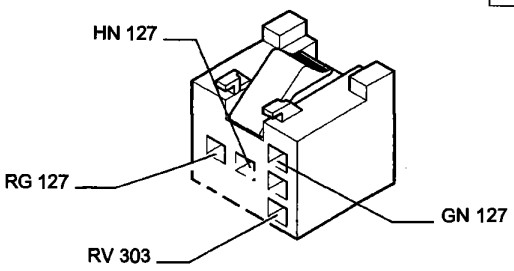
JTD




P4F977N05

## 304 Diesel preheating protection relay

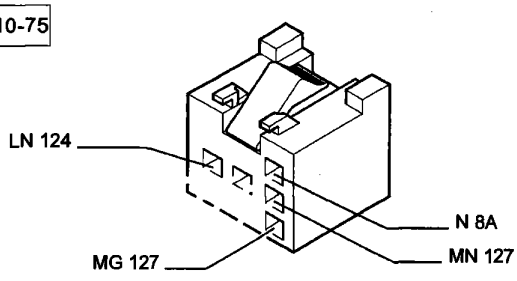
JTD




P4F977N06

## 305 Compressor deactivation relay

1910-75



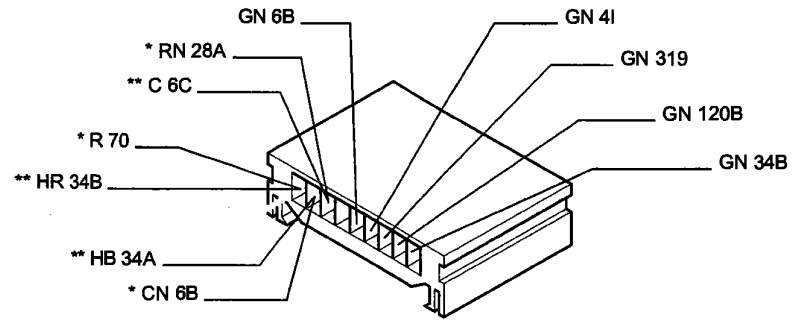

P4F977N07



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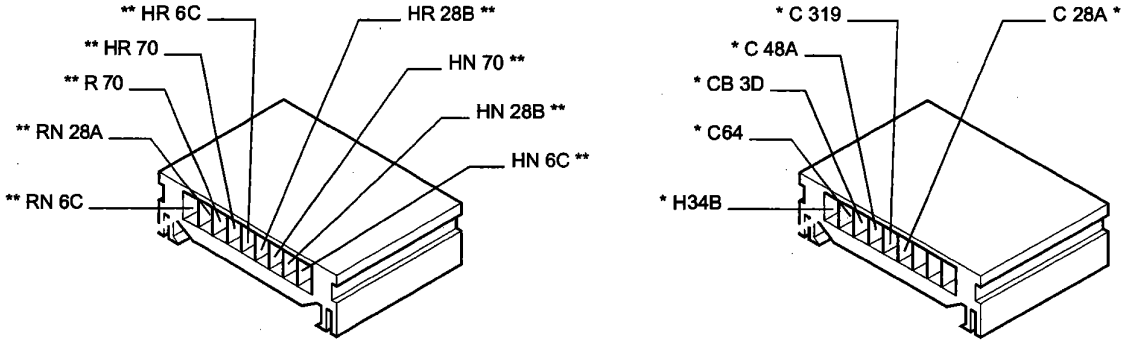
# 55.

## 310A Connection shunt



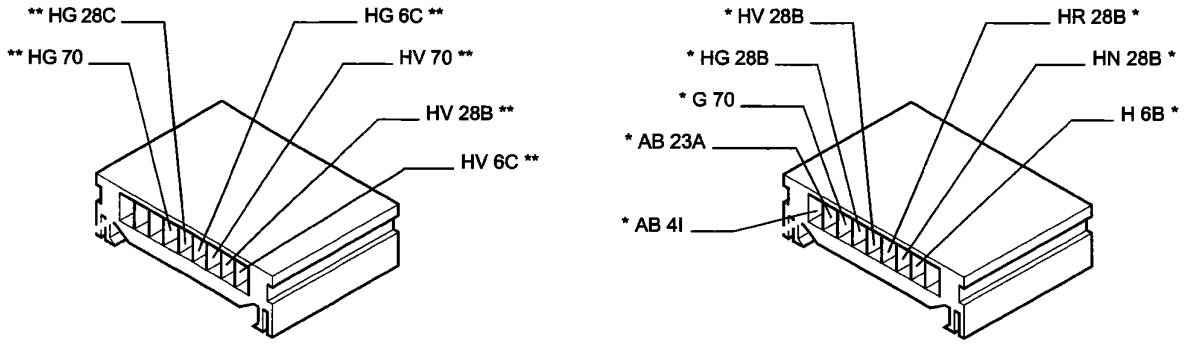

P4F978N05

## 310B Connection shunt



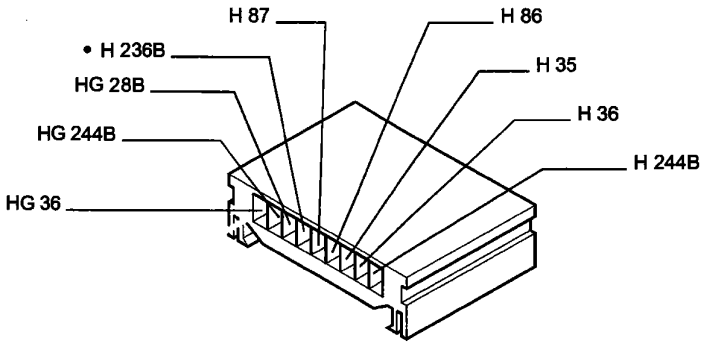

P4F978N06

## 310C Connection shunt




P4F978N07

## 310D Connection shunt




* Marea Weekend

P4F978N08

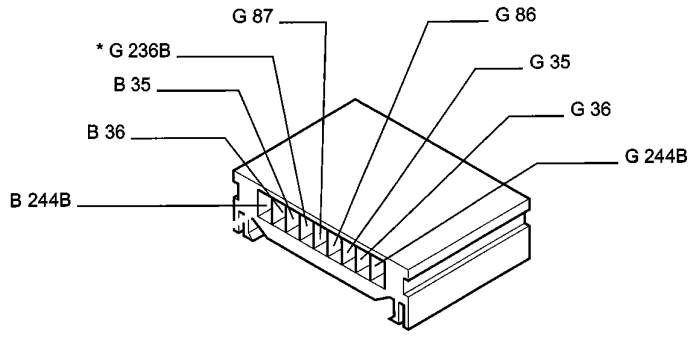
(*) from Nov. 99

(**) up to Nov. 99




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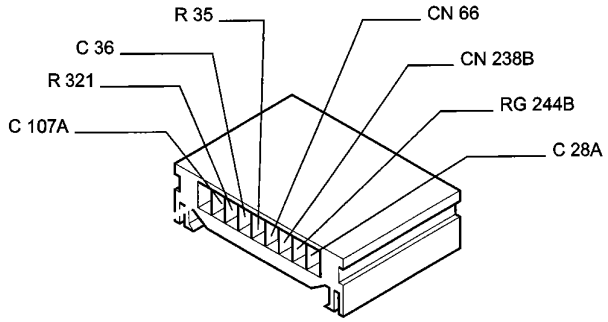
## 310E Conecting bridge




* Marea Weekend

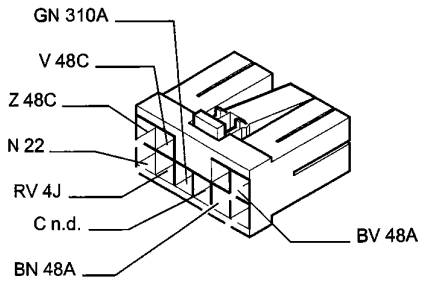
P4F979N01

## 310F Connecting bridge



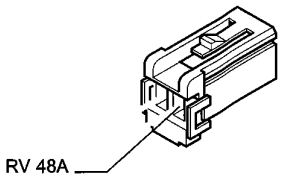

P4F979N02

## 319 Connection for radio phone



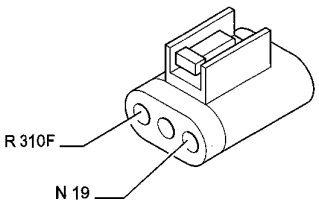

P4F979N03

## 320 Aerial feeder



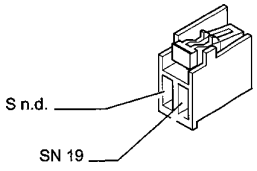

P4F979N04

## 321 Connection for TELEPASS




P4F979N05

## 322 Connection for seat height adjustment




P4F979N06

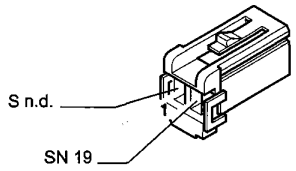
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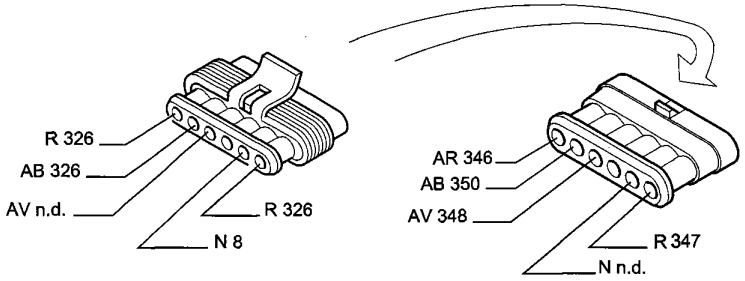
# 55.

## 323 Connection for seat lumbar adjustment



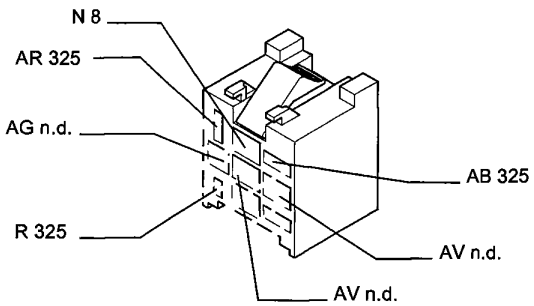

P4F980N01

## 325 Connection for additional heater



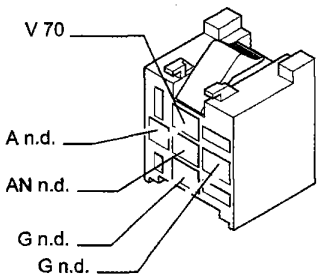

P4F980N02

## 326 Additional heater control unit



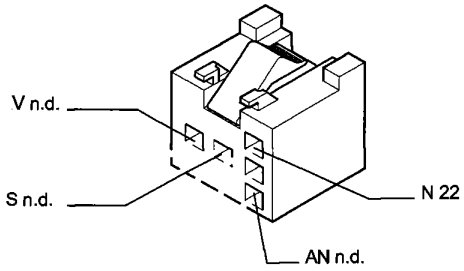

P4F980N03

## 328 Hazard warning lights relay




P4F980N04

## 332 Power relay controlled by ignition



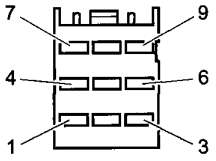

P4F980N05




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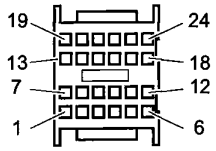
## 333 Injection control unit (JTD)

| | | | |
|---|---|---|---|
| A1 | C 344 | A6 | N n.d. |
| A4 | N n.d. | A7 | B n.d. |
| A5 | N n.d. | A8 | B n.d. |



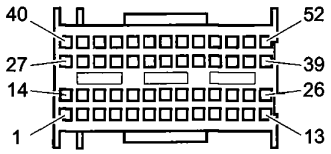

A

| | | | |
|---|---|---|---|
| B1 | G 201B | B8 | SN 55A |
| B2 | BL 55A | B13 | C 55A |
| B3 | ZB 55C | B23 | GN 55C |




B

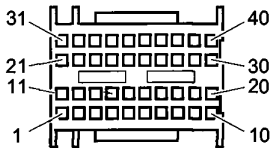
| | | | |
|---|---|---|---|
| C1 | NZ 345 | C20 | BG 55C |
| C5 | LB 291 | C21 | L 291 |
| C8 | N 291 | C22 | LG 291 |
| C9 | BN 291 | C23 | B 345 |
| C10 | RG 291 | C26 | G 55A |
| C13 | HV 55A | | |




C

| | | | |
|---|---|---|---|
| C28 | BR 139 | C46 | S 150 |
| C37 | CV 285 | C48 | S 55A |
| C38 | C 201B | C50 | HG 285 |
| C40 | ZN 55A | C51 | MG 201B |
| C43 | MZ 55A | C52 | SN 151 |
| C45 | GL 55C | | |

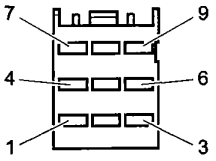
| | | | |
|---|---|---|---|
| D1 | CN 167 | D8 | LR 343 |
| D2 | C 168 | D11 | VN 167 |
| D3 | L 168 | D13 | LG 342 |
| D4 | NZ 167 | D14 | HR 167 |
| D6 | HM 343 | D15 | B 55C |
| D7 | HN 343 | | |




D

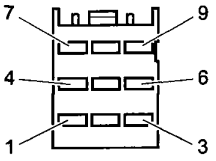
| | | | |
|---|---|---|---|
| D21 | HB 341 | D31 | CB 341 |
| D23 | G 167 | D32 | HL 55A |
| D24 | HV 342 | D34 | H 342 |
| D26 | R 144 | D36 | BN 334 |
| D27 | LN 334 | D37 | B 144 |

| | | | |
|---|---|---|---|
| E2 | NV n.d. | E5 | MV 338 |
| E3 | VB 339 | E7 | V 337 |
| E4 | VN n.d. | E9 | NL 336 |




E 1910-JTD

| | | | |
|---|---|---|---|
| F1 | VN n.d. | F7 | VB 339 |
| F3 | VG 340 | F8 | MV 338 |
| F4 | NV n.d. | F9 | V 337 |
| F5 | NL 336 | | |




E 2387-JTD

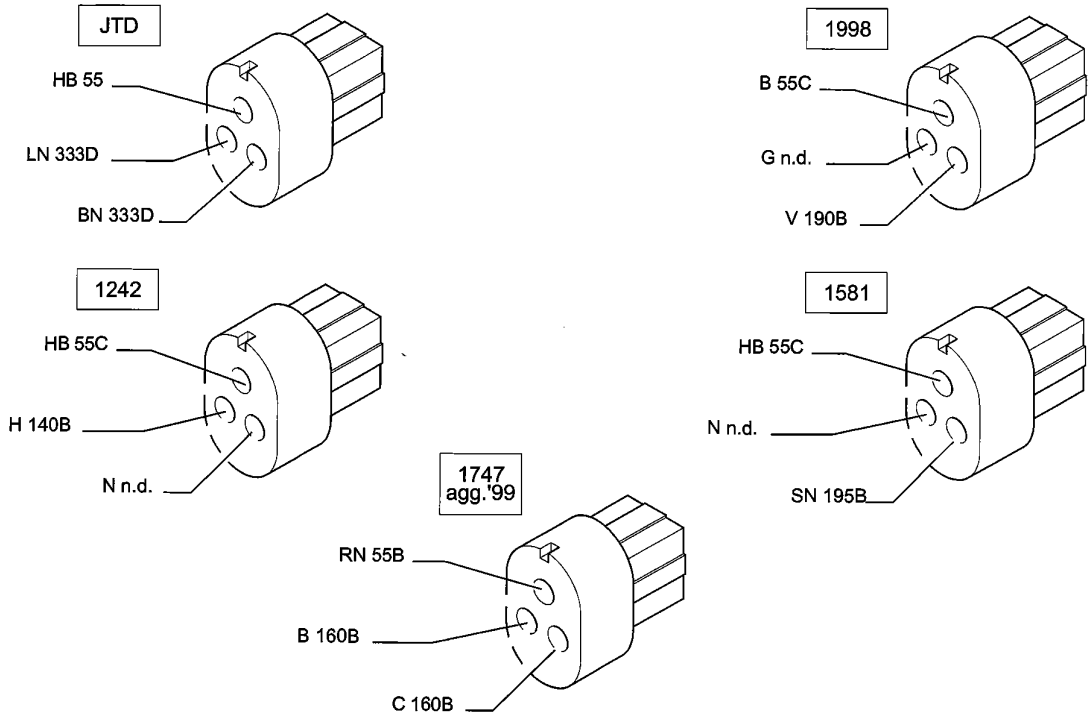
P4F981N01



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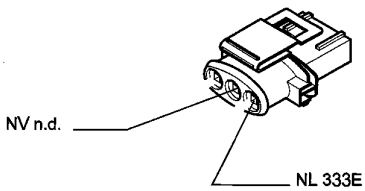
# 55.

## 334 Engine temperature twin sender unit



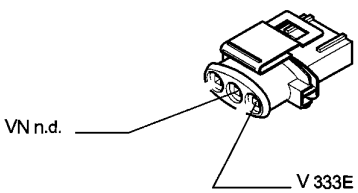

P4F982N01

## 336 Injector for cylinder 1 (JTD)



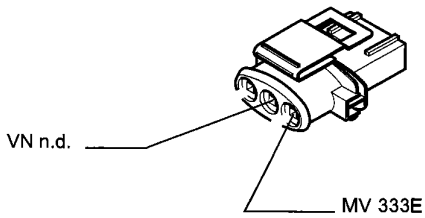

P4F982N02

## 337 Injector for cylinder 2 (JTD)



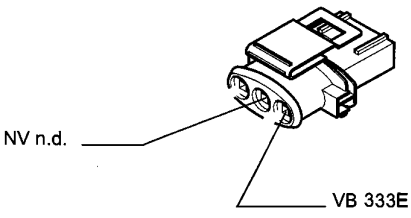

P4F982N03

## 338 Injector for cylinder 3 (JTD)




P4F982N04

## 339 Injector for cylinder 4 (JTD)

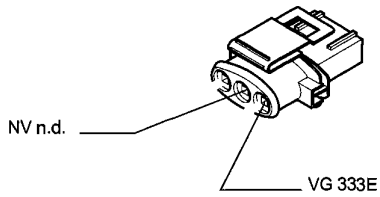



P4F982N05



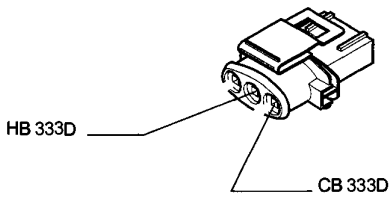

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**340** Injector for cylinder 5 (2387 JTD)



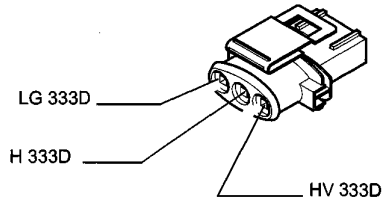

P4F983N01

**341** Fuel pressure regulator (JTD)



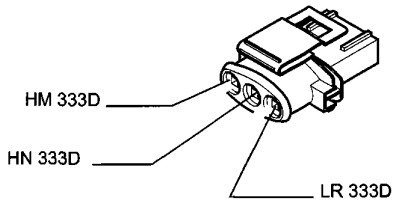

P4F983N02

**342** Fuel pressure sensor (JTD)



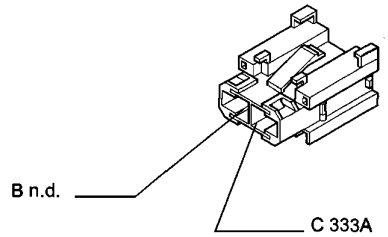

P4F983N03

**343** Turbo pressure sensor (JTD)



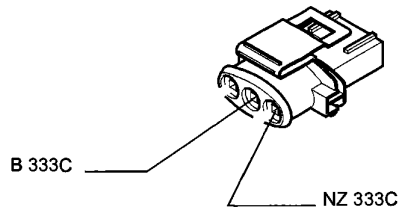

P4F983N04

**344** I.E. protective fuse (JTD)



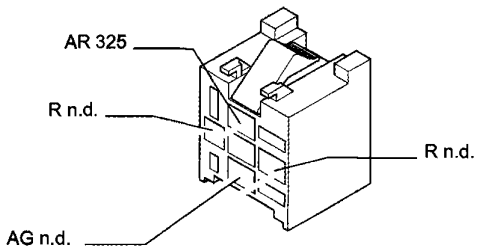

P4F983N05

**345** Fuel temperature sensor (JTD)



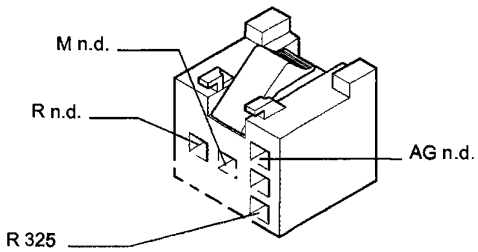

P4F983N06

**346** Additional heater relay




P4F983N07

**347** Additional heater relay



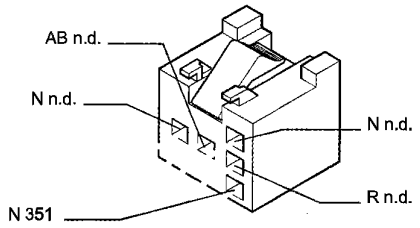

P4F983N08



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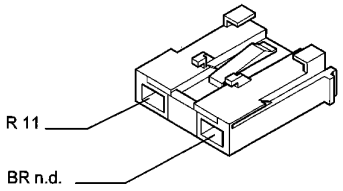
# 55.

## 348 Additional heater remote control switch



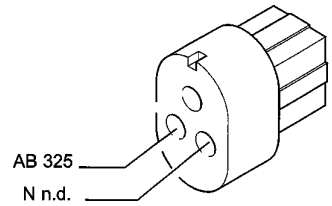

P4F984N01

## 349 Additional heater protective fuse



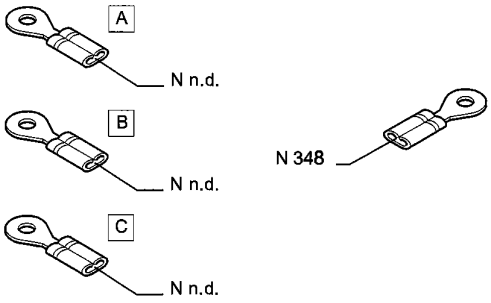

P4F984N02

## 350 Additional heater sensor



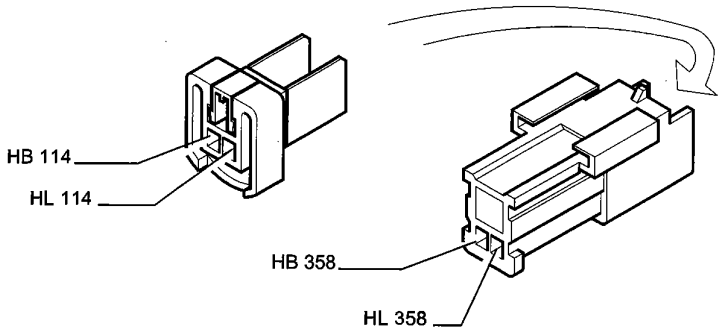

P4F984N03

## 351 Additional heater heater plug



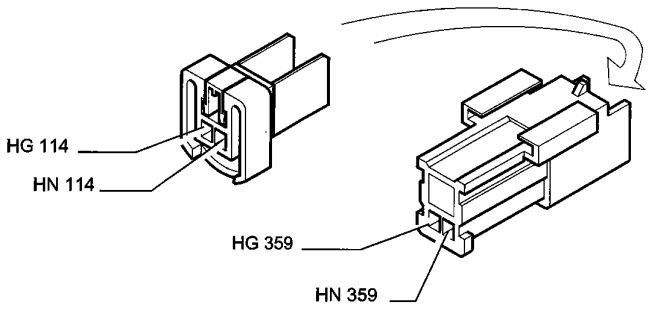

P4F984N04

## 352 Left Side Bag connection




P4F984N05

## 353 Right Side Bag connection

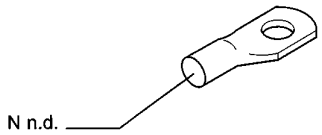



P4F984N06



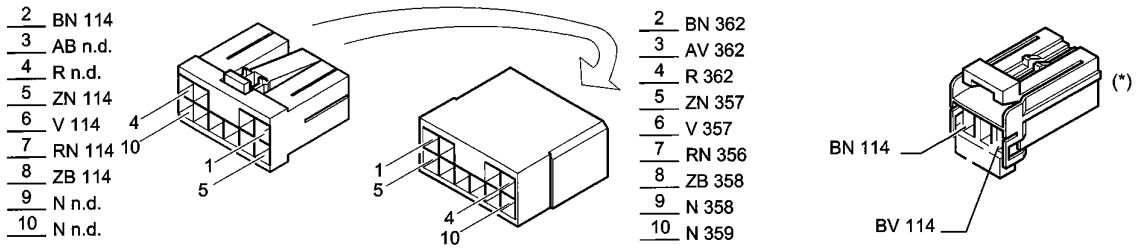

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## 354 Air Bag earth




P4F986N01

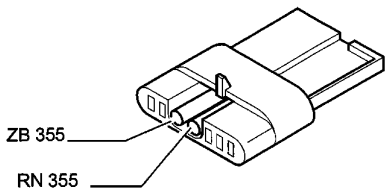
## 355 Pretensioner connections




* Without Side Bag

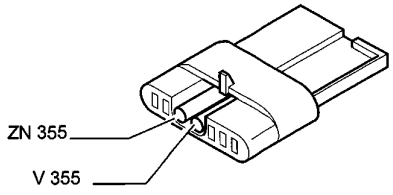
P4F985N02

## 356 Left Side Bag sensor



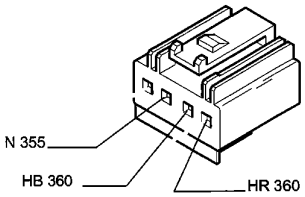

P4F985N03

## 357 Right Side Bag sensor



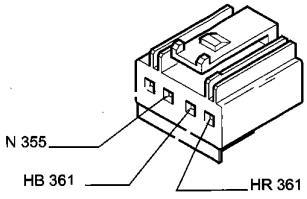

P4F985N04

## 358 Left Side Bag




P4F985N05

## 359 Right Side Bag



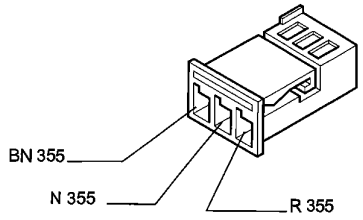

P4F985N06

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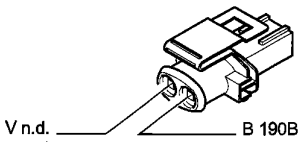
### 362 Passenger presence sensor




P4F986N01

### 363 Phase transformer actuator (1998)

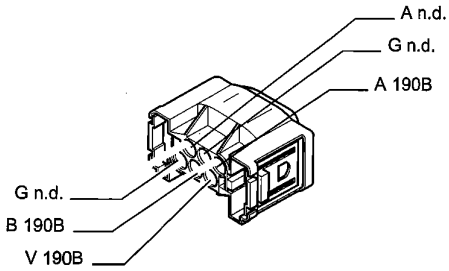
1998




P4F986N02

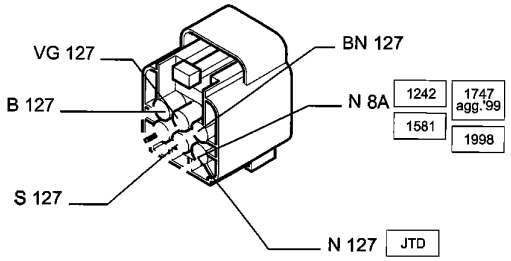
### 364 Motorized butterfly casing

1998




P4F986N03

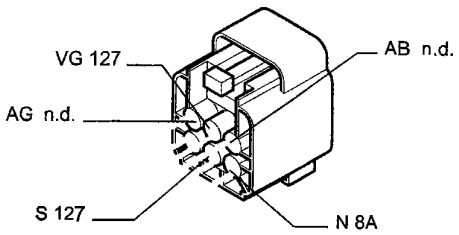
### 365 4 stage pressure switch




P4F986N04

### 365 4 stage pressure switch

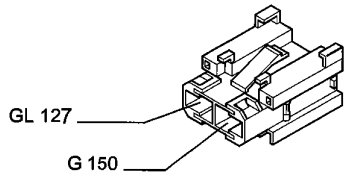
1910-75




P4F986N05

### 368 Diode for injection system relay

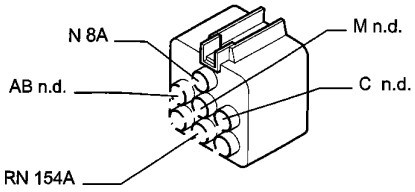
1747




P4F986N06

### 369 Engine cooling fan remote control switch

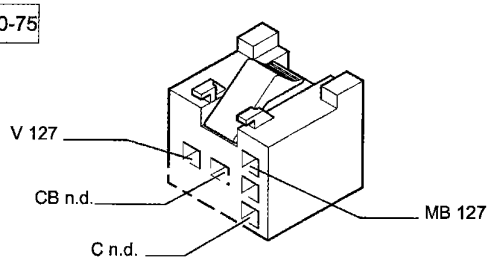
1910-JTD




P4F986N07

### 370 Inertia switch relay (1910 TD-75)

1910-75

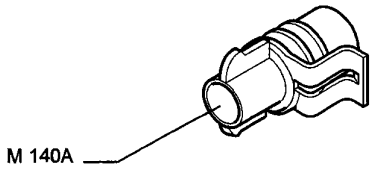



P4F986N08



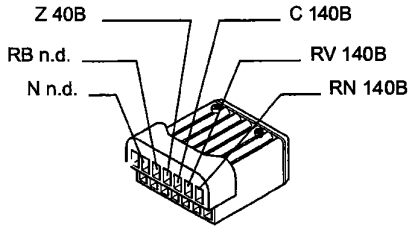

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## 371 Connection for tester




P4F987N01

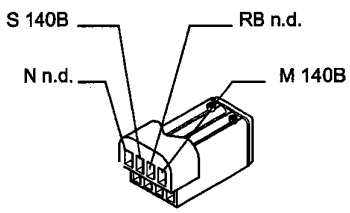
## 372 Modular actuator




P4F987N02

## 373 Air temperature and pressure sensor

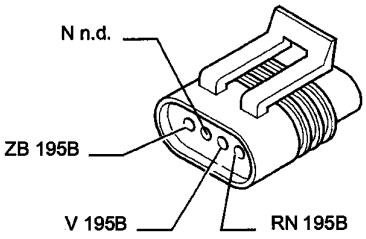
1242




P4F987N05

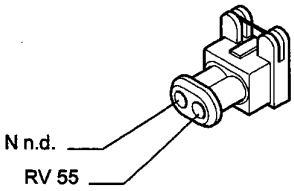
## 373 Air temperature and pressure sensor

1581




P4F987N06

## 374 Power steering pump sensor




P4F987N05



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page

- Electrical symbols 1
- Explanation of how to read wiring diagrams 4
- Wiring diagrams 5
- Key 189

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| DESCRIPTION | Marea-Marea Weekend | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | SX | | ELX | | | | | HLX | |
| | 1242 | 1910 TD-75 | 1581 | 1581 a.c. | 1747 | 1747 agg. 99 | 1910 JTD | 1998 | 2387 JTD |
| Versions with Check Panel, polyelliptical headlamps<br>Side lights and warning light - Dipped headlamps - Main beam headlamps and warning light - Number plate lights | - | - | 5 (**) | 5 (**) | 5 (**) | 5 (**) | 5 (**) | 5 (**) | 5 (**) |
| Versions without Check Panel, polyelliptical headlamps<br>Side lights and warning light - Dipped headlamps - Main beam headlamps and warning light - Number plate lights | - | - | 7 | 7 | 7 | 7 | 7 | - | - |
| Versions without Check Panel, reflector headlamps<br>Side lights and warning light - Dipped headlamps - Main beam headlamps and warning light - Number plate lights | 9 | 9 | - | - | - | - | - | - | - |
| Fog lights - Rear fog lamps | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| Versions with Check Panel and alarm<br>Direction indicators and warning light - Hazard warning lights - Brake lights - Reversing light | - | - | 13**<br>14** | 13**<br>14** | 13**<br>14** | 13**<br>14** | 13**<br>14** | 13**<br>14** | 13**<br>14** |
| Versions with Check Panel, without alarm<br>Direction indicators and warning light - Hazard warning lights - Brake lights - Reversing light | - | - | 15**<br>16** | 15**<br>16** | 15**<br>16** | 15**<br>16** | 15**<br>16** | 15**<br>16** | 15**<br>16** |
| Versions without Check Panel, with alarm<br>Direction indicators and warning light - Hazard warning lights - Brake lights - Reversing light | 17 | 17 | 17 | 17 | 17 | 17 | 17 | - | - |
| Versions without Check Panel, without alarm<br>Direction indicators and warning light - Hazard warning lights - Brake lights - Reversing light | 19 | 19 | 19 | 19 | 19 | 19 | 19 | - | - |
| Fiat Marea<br>Car interior ghting - Symbol lighting | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| Fiat Marea Weekend<br>Car interior ghting - Symbol lighting | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
| Radio system (high level: AD 185 H) - Cigarette lighter | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| Radio system (mid-level: AD 185 M) - Cigarette lighter | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 |
| Electric front windows | 29 | 29 | 29 | 29 | 29 | 29 | 29 | 29 | 29 |
| Rear electric windows | - | - | 31 | 31 | 31 | 31 | 31 | 31 | 31 |
| FIAT CODE and warning light | 33 | 35 | 33 | 33 | 33 | 33 | 35 | 33 | 35 |

**NOTE** *The numbers in the table correspond to the page number of the wiring diagram*

* From November '99

** Only up to November '99

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| DESCRIPTION | Marea-Marea Weekend | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | SX | | ELX | | | | | HLX | |
| | 1242 | 1910 TD-75 | 1581 | 1581 a.c. | 1747 | 1747 agg. 99 | 1910 JTD | 1998 | 2387 JTD |
| Alarm/Door check device | 37** 38** | 37** 38** | 37** 38** | 37** 38** | 37** 38** | 37** 38** | 37** 38** | 37** 38** | 37** 38** |
| Central locking | 39 | 39 | 39 | 39 | 39 | 39 | 39 | 39 | 39 |
| Electrically-adjustable, heated door mirror | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 |
| Predisposition for car phone and TELEPASS | 43 | 43 | 43 | 43 | 43 | 43 | 43 | 43 | 43 |
| Electric sun-roof | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 |
| Headlamp alignment corrector | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 |
| Adjustable, heated front seats | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 |
| Air Bag, pretensioners and failure warning light | 51 | 51 | 51 | 51 | 51 | 51 | 51 | 51 | 51 |
| Air Bag with Side Bag and pretensioners and failure warning light | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 |
| Windscreen wash/wipe - Rear wash/wipe - Horn - Heated rear window - Headlamp washers | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 |
| Instrument panel connections | 57** 58** | 57** 58** | 57** 58** | 57** 58** | 57** 58** | 57** 58** | 57** 58** | 57** 58** | 57** 58** |
| Check Panel/Door check connections | - | - | 59** 60** | 59** 60** | 59** 60** | 59** 60** | 59** 60** | 59** 60** | 59** 60** |
| Thermostatically-controlled climate control system/heater | 73 | 71 | 69 | 69 | 67 | 65 | 63 | 61 | 63 |
| Additional heater | - | - | - | - | - | - | 75 | - | 75 |
| Versions with climate control Engine cooling | 85 | 87 | 85 | 85 | 83 | 77 | 81 | 77 | 79 |
| Versions without climate control Engine cooling | 89 | 87 | 89 | 89 | 89 | 89 | 81 | 89 | 79 |

NOTE *The numbers in the table correspond to the page number of the wiring diagram*

* From November '99

** Only up to November '99



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| DESCRIPTION | Marea-Marea Weekend | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | SX | | ELX | | | | | HLX | |
| | 1242 | 1910 TD-75 | 1581 | 1581 a.c. | 1747 | 1747 agg. 99 | 1910 JTD | 1998 | 2387 JTD |
| Anti-locking braking system (ABS) and failure warning light | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 |
| Starting - Electronic ignition and injection - Recharging and warning light - Insufficient engine oil pressure warning light - Injection system failure warning ilight - Rev couner | 101 | - | 99 | 99 | 97 | 95 | - | 93 | - |
| Starting - Electronic injection - Recharging and warning light - Low engine oil pressure warning light - Glow plug preheating warning light - Injection system failure warning light - Fuel preheating | - | - | - | - | - | - | 105 | - | 103 |
| Starting - EGR control - Injection control - Glow plug preheating and warning light - Recharging and warning light - Low engine oil pressure warning light | - | 107 | - | - | - | - | - | - | - |
| Automatic transmissiono device - System failure warning light | - | - | - | 109 | - | - | - | - | - |
| Diagnostic sockect connections | 111 | 113 | 111 | 111 | 111 | 111 | 113 | 111 | 113 |

NOTE *The numbers in the table correspond to the page number of the wiring diagram*

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## Electrical symbols

| | | |
|---|---|---|
|  Position |  Cold starting (choke) |  Switch discharge |
|  Main beam headlamps |  Water in fuel filter |  Dipped headlamps |
|  Heated seat |  Heater plugs |  Direction indicators signalling with central locking |
|  Seat belts |  Turbocharging pressure |  Horns |
|  Heated rear windscreen |  Rear fog lamp |  Left direction indicator |
|  Handbrake applied and insufficient brake fluid level |  Fog light |  Right direction indicator |
|  A.B.S. |  Brake pad wear |  Engine cooling |
|  Hazard warning |  Turbocharging pressure |  Windscreen wiper |
|  Direction indicator |  Automatic transmission fluid temperature |  Electronically operated sun roof |
|  Handbrake applied and insufficient brake fluid level |   Speed limit |  Catalytic silencer temperature |
|  Recharing |  Fuel gauge |  Resistance |
|  Engine oil pressure |  Engine coolant temperature |  Diode |

P4F001N01



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# 55.

Electrical symbols

| | | |
|---|---|---|
|  Warning light |  Trip computer operation |  Differential lock |
|  Bulb |  Electronic injection |  Automatic transmission fluid temperature |
|  Fuse |  Engine oil level |  Temperature |
|  Switch open |  Brake fluid level (Japanese Version) |  Anti-theft |
|  Selector switch |  Doors open |  Electric windows |
|  Switch operated by coil (relay) |  Central locking |  Earth |
|  Engine |  Controlled damping suspension Sport Function |  No. plate lights |
|  Rearscreen wiper |  Transistor |  Impulse generator (timer) |
|  Headlamp washer |  Air-bag |  Analogue clock |
|  Windscreen wash/wipe |  A.B.S. (Japanese Version) |  Digital clock |
|  Rearscreen wash/wipe |  Brake light failure |  Speedometer |
|  Engine oil pressure |  Windscreen wiper |  Rev counter |

P4F002N01




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## Electrical symbols


Digital speedometer


Digital rev counter


Digital fuel gauge


Analogue fuel gauge


Analogue engine coolant temperature gauge


Econometer


Digital engine coolant temperature gauge


Engine oil temperature


Engine oil pressure gauge


Voltmeter

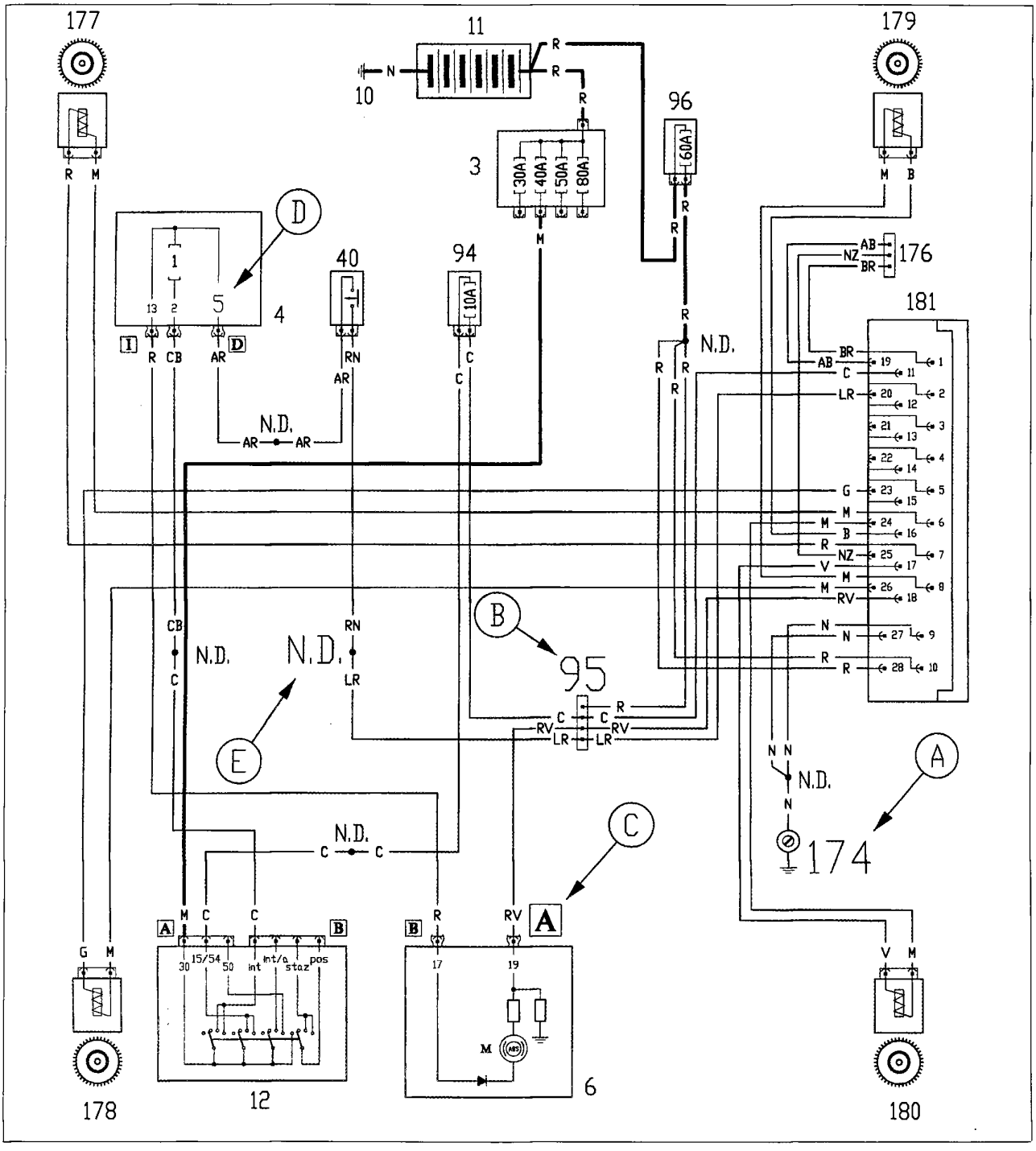
P4F003N01



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# 55.

**Explanation of how to read wiring diagrams**




4F004N01

### Reference key

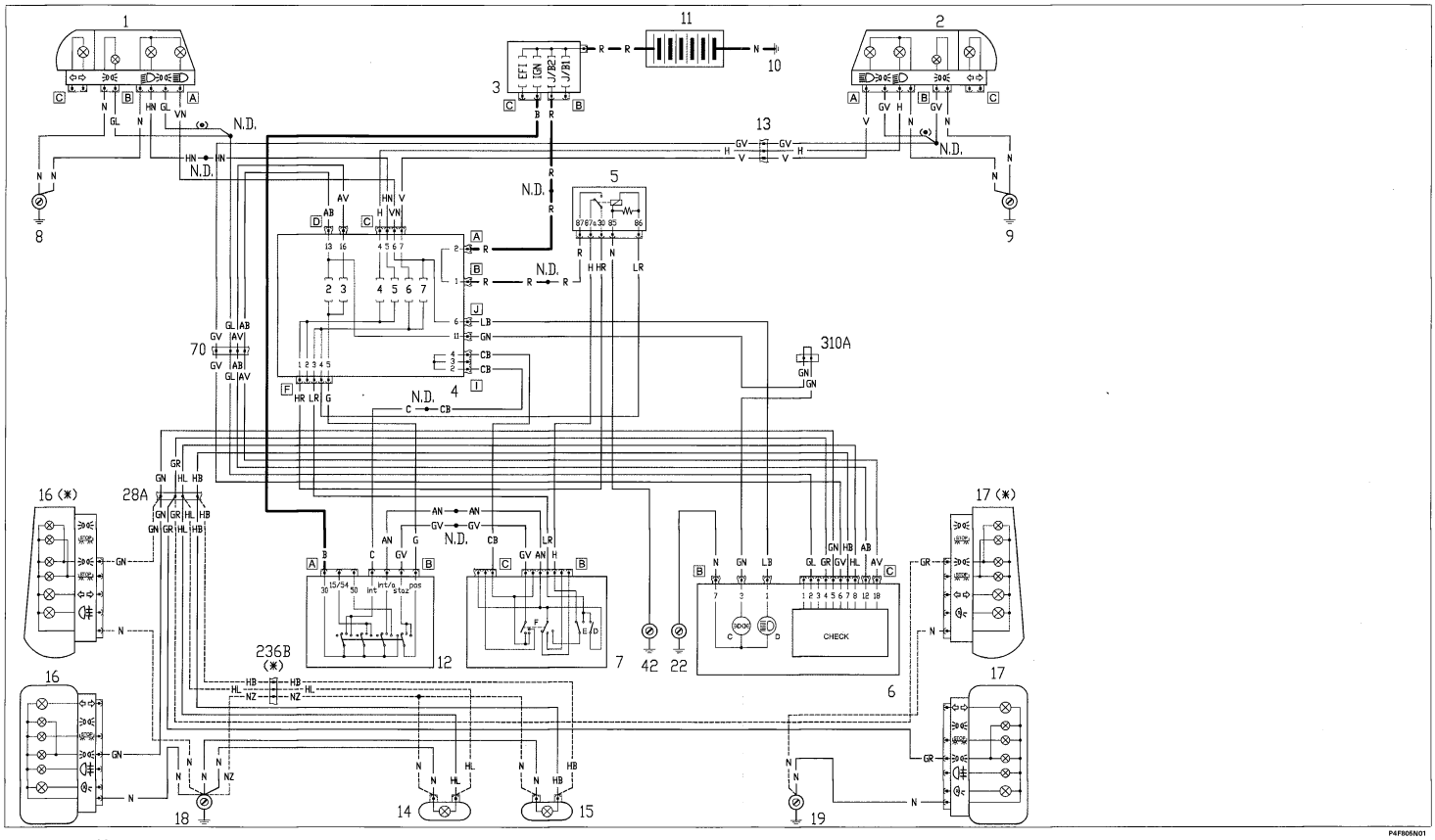
A Component number
B Connection number
C Connector identification at component
D Connecting pin number
E Ultrasound welding




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## 55.

**Versions with Check Panel, polyeliptical headlamps**
**Side lights and warning light - Dipped headlamps - Main beam headlamps and warning light - No. plate lights**




* Variants for Marea Weekend

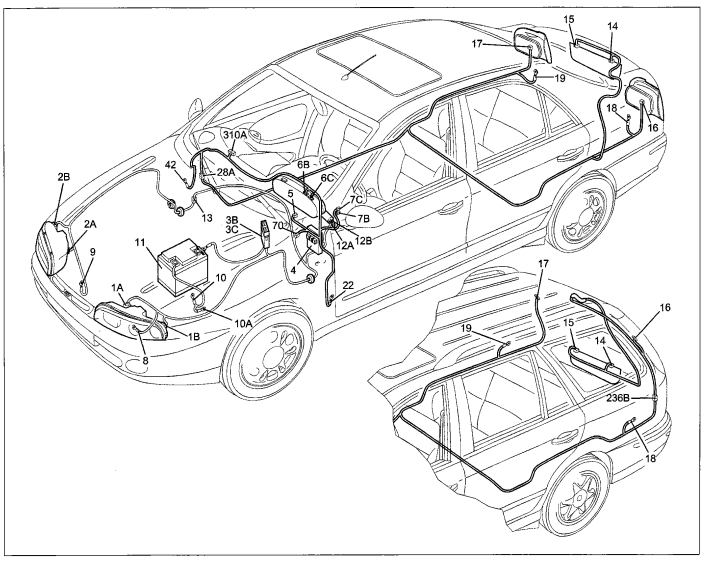
• Wire not connected

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## 55.



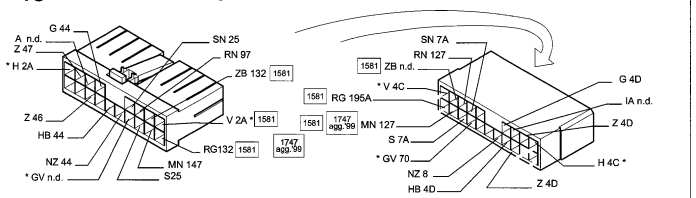

P4F806N01

**Versions with Check Panel, polyeliptical headlamps**
**Side lights and warning light - Dipped headlamps - Main beam headlamps and warning light**
**No. plate lights**

**Key to components**

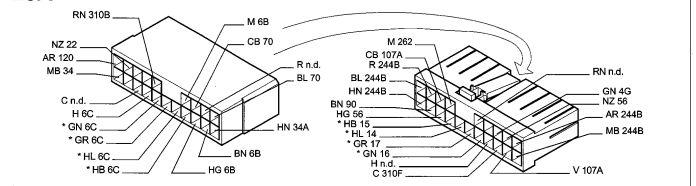
1 Left front light cluster
2 Right front light cluster
3 Power fuse box
4 Junction unit
5 Dipped headlamps relay feed
6 Instrument panel
7 Stalk unit
8 Left front earth
9 Right front earth
10 Battery earth on engine
11 Battery
12 Ignition switch
13 Connection between right/left front cables
14 Left no. plate light
15 Right no. plate light
16 Left rear light cluster
17 Right rear light cluster
18 Left rear earth
19 Right rear earth
22 Left facia earth
28 Connection between dashboard/rear cables
42 Right dashboard earth
70 Connection between dashboard/front cable
236 Connection between rear cable and tailgate
310 Connecting bridge

**13** Connction between right/left front cables




P4F806N02

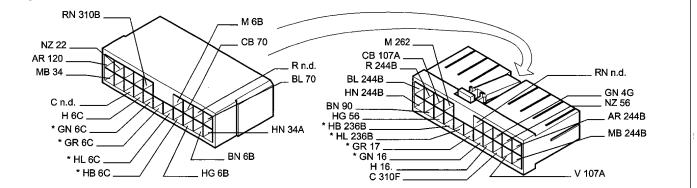
**28A** Connection between dashboard/rear cables




Marea

P4F806N03

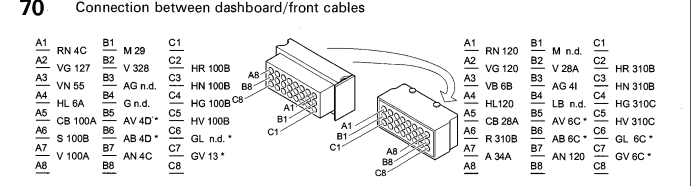
**28A** Connection between dashboard/rear cables




Marea Weekend

P4F806N04

**70** Connection between dashboard/front cables




P4F806N05

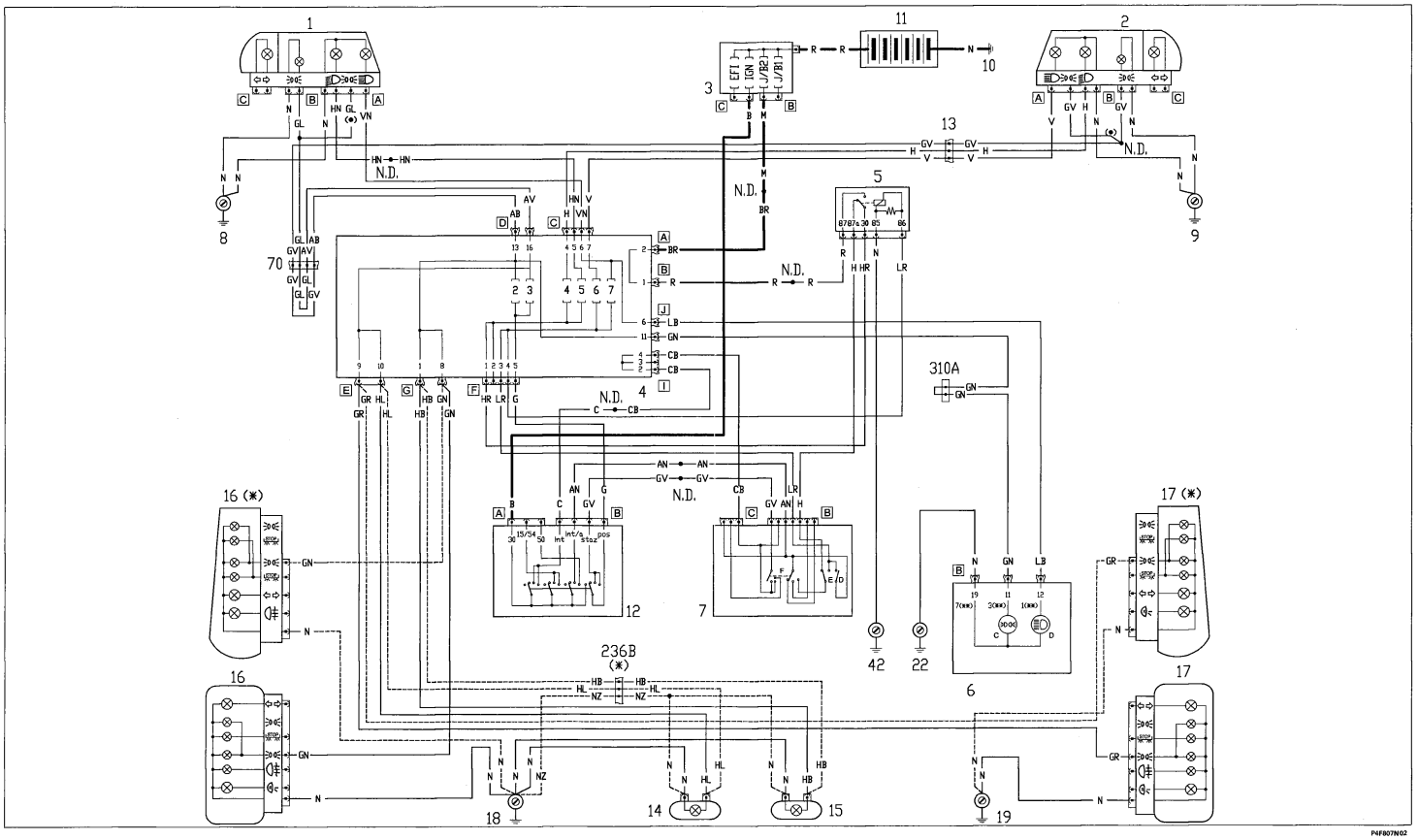
* The cables concerned are marked in the wiring diagram with an asterisk



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## 55.

**Versions without Check Panel, polyelliptical headlamps**
**Side lights and warning light - Dipped headlamps - Main beam headlamps and warning light -Number plate lights**




* Variant for Marea Weekend

** Variant up to Nov. '99

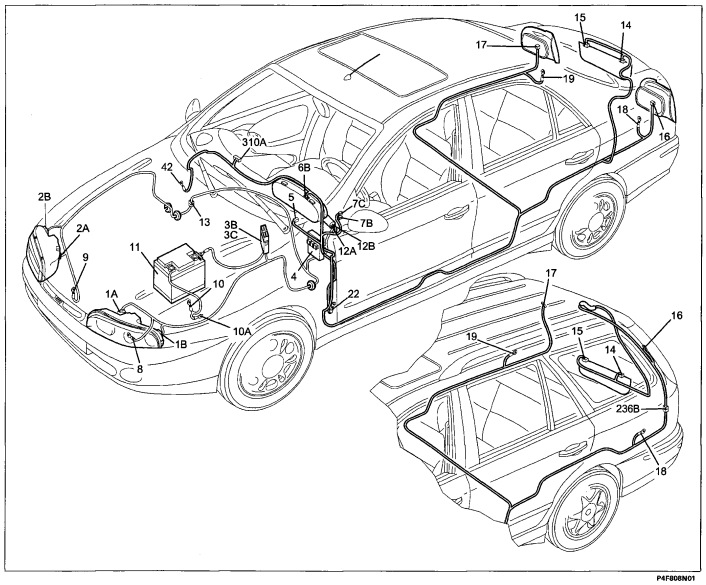
• Wire not connected

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## 55.

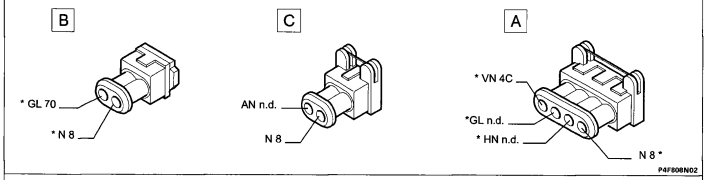



**Versions without Check Panel, polyelliptical headlamps**
**Side lights and warning light - Dipped headlamps - Main beam headlamps and warning light - Number plate lights**

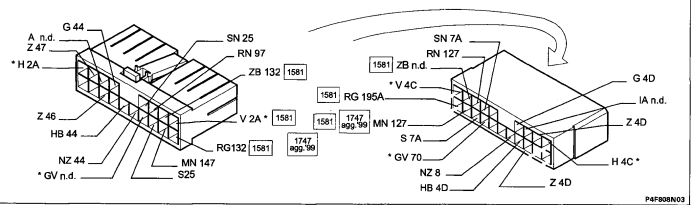
Component key

1 Left front light cluster
2 Right front light cluster
3 power fusebox:
4 Junction unit:
5 Dipped headlamps relay
6 Instrument panel
7 Stalk unit
8 Left front earth
9 Right front earth
10 Engine battery earth
11 Battery
12 Ignition switch
13 Connection between right/left front cables
14 Left number plate light bulb
15 Right number plate light bulb
16 Left rear light cluster
17 Right rear light cluster
18 Left rear earth
19 Right rear earth
22 Left facia earth
42 Right facia earth
236 Connection between rear cables and tail-gate
310 Connection bridge

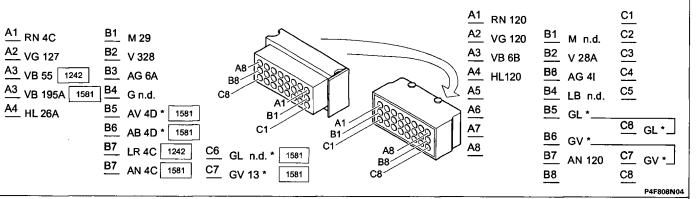
**1** Left front light cluster



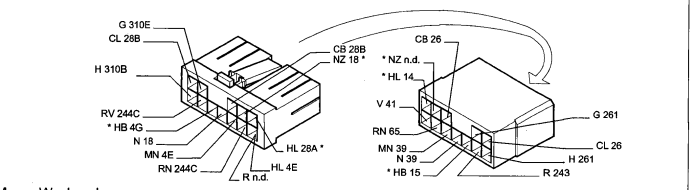

**13** Connection between right/left front cables




**70** Connection between dashborad/front cables




**236B** Connection betwen rear lead and tail-gate



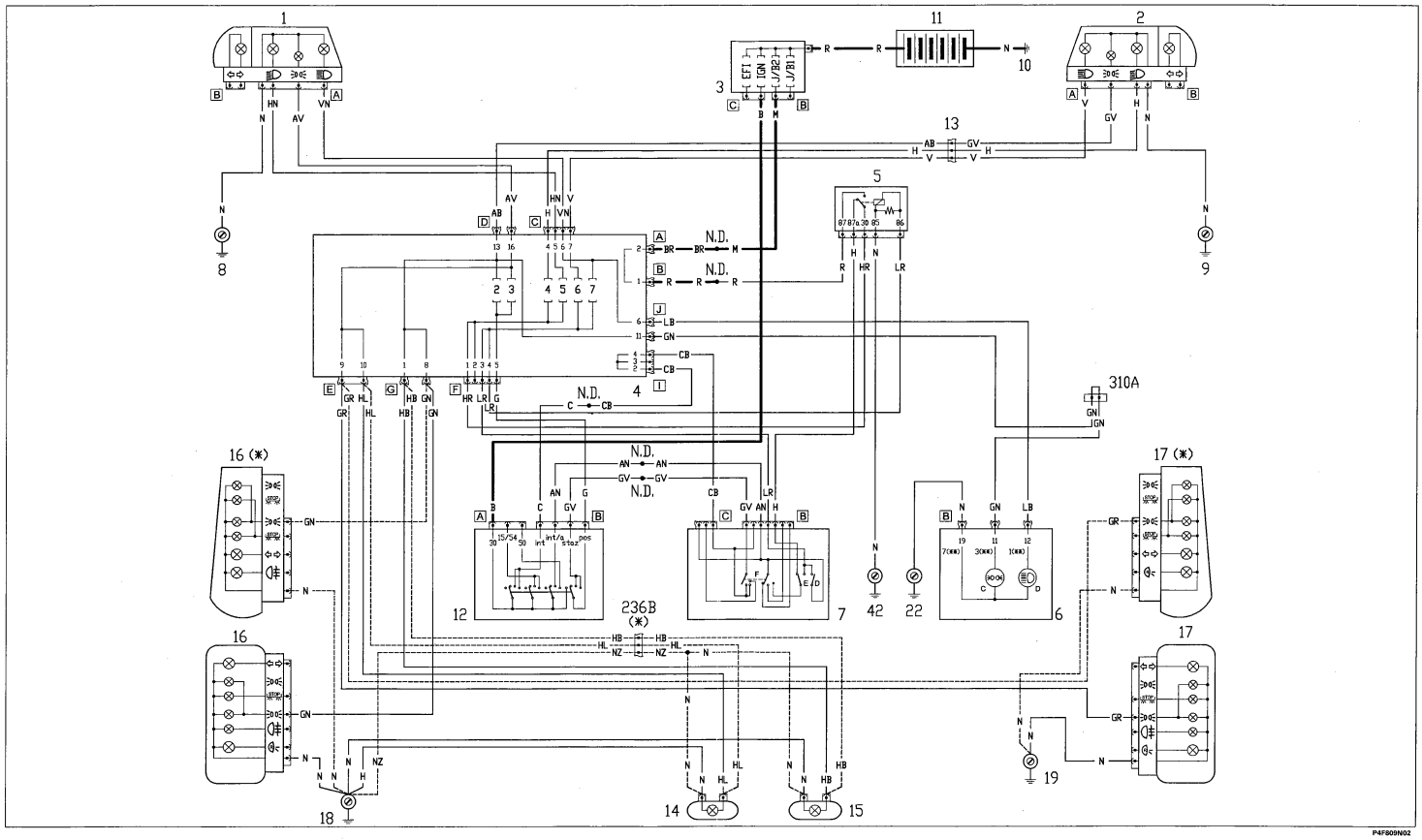

(*) The cables involved in the wiring diagram are marked with an asterisk.



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## 55.

**Versions without Check Panel, reflector headlamps**
**Side lights and warning light - Dipped headlamps - Main beam headlamps and warning light -Number plate lights**




P4F809N02

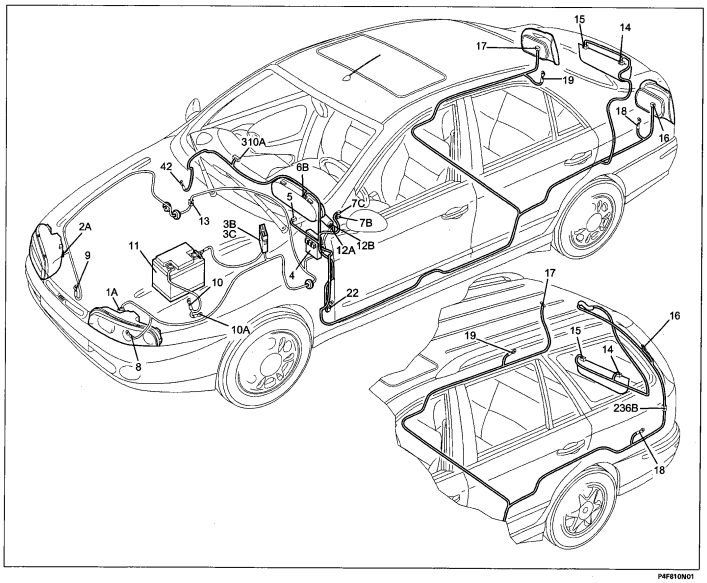
* Variant for Marea Weekend

** Variant up to Nov. '99



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## 55.



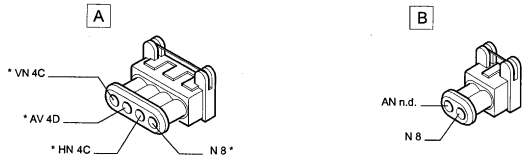

P4F810N01

**Versions without Check Panel, reflector headlamps**
**Side lights and warning light - Dipped headlamps - Main beam headlamps and warning light - Number plate lights**

Component key

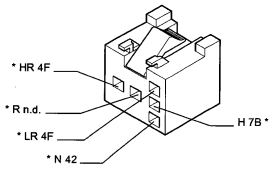
1 Left front light cluster
2 Right front light cluster
3 power fusebox:
4 Junction unit:
5 Dipped headlamps relay
6 Instrument panel
7 Stalk unit
8 Left front earth
9 Right front earth
10 Engine battery earth
11 Battery
12 Ignition switch
13 Connection between right/left front cables
14 Left number plate light bulb
15 Right number plate light bulb
16 Left rear light cluster
17 Right rear light cluster
18 Left rear earth
19 Right rear earth
22 Left facia earth
42 Right facia earth
236 Connection between rear cables and tail-gate
310 Connection bridge

**1** Left front light cluster



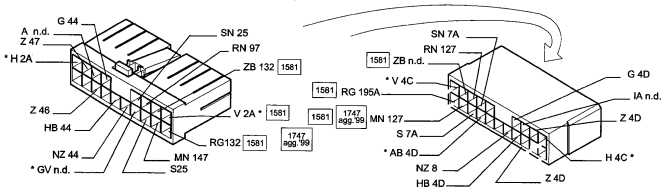

P4F810N02

**5** Dipped headlamps relay feed



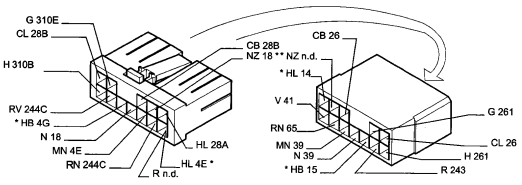

P4F810N03

**13** Connection between right/left front cables




P4F810N04

**236B** Connection betwen rear lead and tail-gate




Marea Weekend

P4F810N05

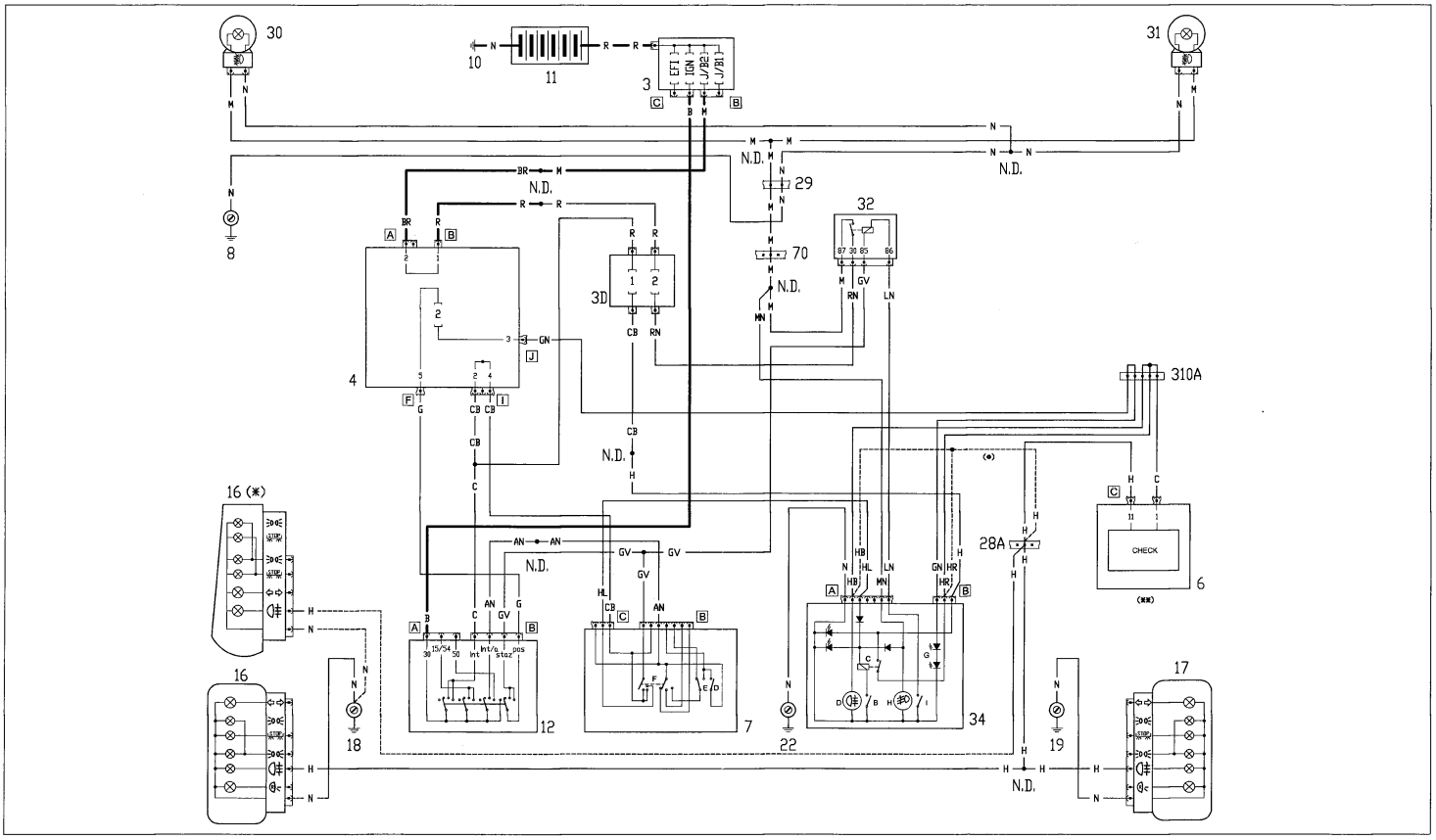
(*) The cables involved in the wiring diagram are marked with an asterisk.



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## 55.

**Fog lights - Rear fog lamps**




* Variant for Marea Weekend

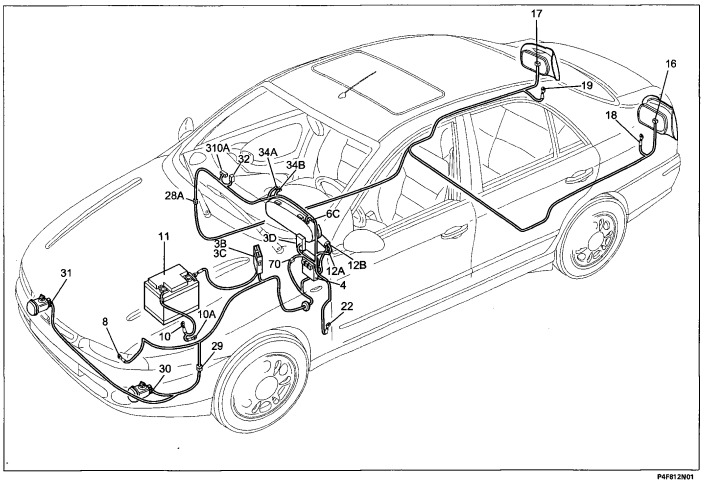
** Variant up to Nov. '99

• Without Check Panel all versions from November '99



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## 55.



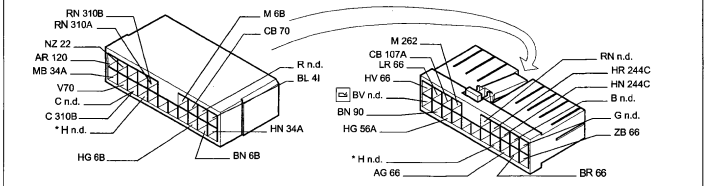

P4F812N01

**Fog lights - Rear fog lamps**

Component key

3 power fusebox:
4 Junction unit:
6 Instrument panel
8 Left front earth
10 Engine battery earth
11 Battery
12 Ignition switch
16 Left rear light cluster
17 Right rear light cluster
18 Left rear earth
19 Right rear earth
22 Left facia earth
28 Connection between facia/rear leads
29 Connection between front/fog lamp leads
30 Left foglamp
31 Right foglamp
32 Fog lights relay
34 Switch control unit
70 Connection between dashborad/front cables
310 Connection bridge

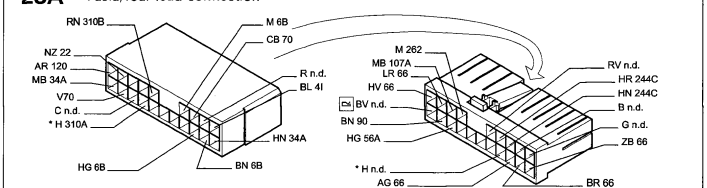
**28A** Facia/rear lead connection




With Check Panel

P4F812N06

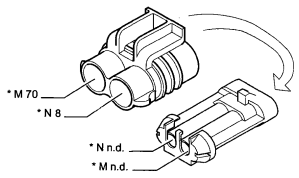
**28A** Facia/rear lead connection




Without Check Panel

P4F812N03

**29** Front/fog lamp lead connection




P4F812N04

**70** Connection between dashborad/front cables

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | RN 4C | B1 | M 29 * | C1 | | A1 | RN 120 | B1 | M n.d. * | C1 | | | | | |
| A2 | VG 127 | B2 | V 328 | C2 | | A2 | VG 120 | B2 | V 28A | C2 | | | | | |
| A3 | VN 55 | B3 | AG n.d. | C3 | HR 100B | A3 | VB 6B | B3 | AG 4I | C3 | HN 310B | | | | |
| A4 | HL 6A | B4 | G n.d. | C4 | HN 100B | A4 | HL120 | B4 | LB n.d. | C4 | HG 310C | | | | |
| A5 | CB 100A | B5 | AV 4D | C5 | HG 100B | A5 | CB 28A | B5 | AV 6C | C5 | HV 310C | | | | |
| A6 | S 100B | B6 | AB 4D | C6 | HV 100B | A6 | R 310B | B6 | AB 6C | C6 | GL 6C | | | | |
| A7 | V 100A | B7 | AN 4C | C7 | GL n.d. | A7 | A 34A | B7 | AN 120 | C7 | GV 6C | | | | |
| A8 | | B8 | | C8 | GV 13 | A8 | | B8 | | C8 | | | | | |

P4F812N05

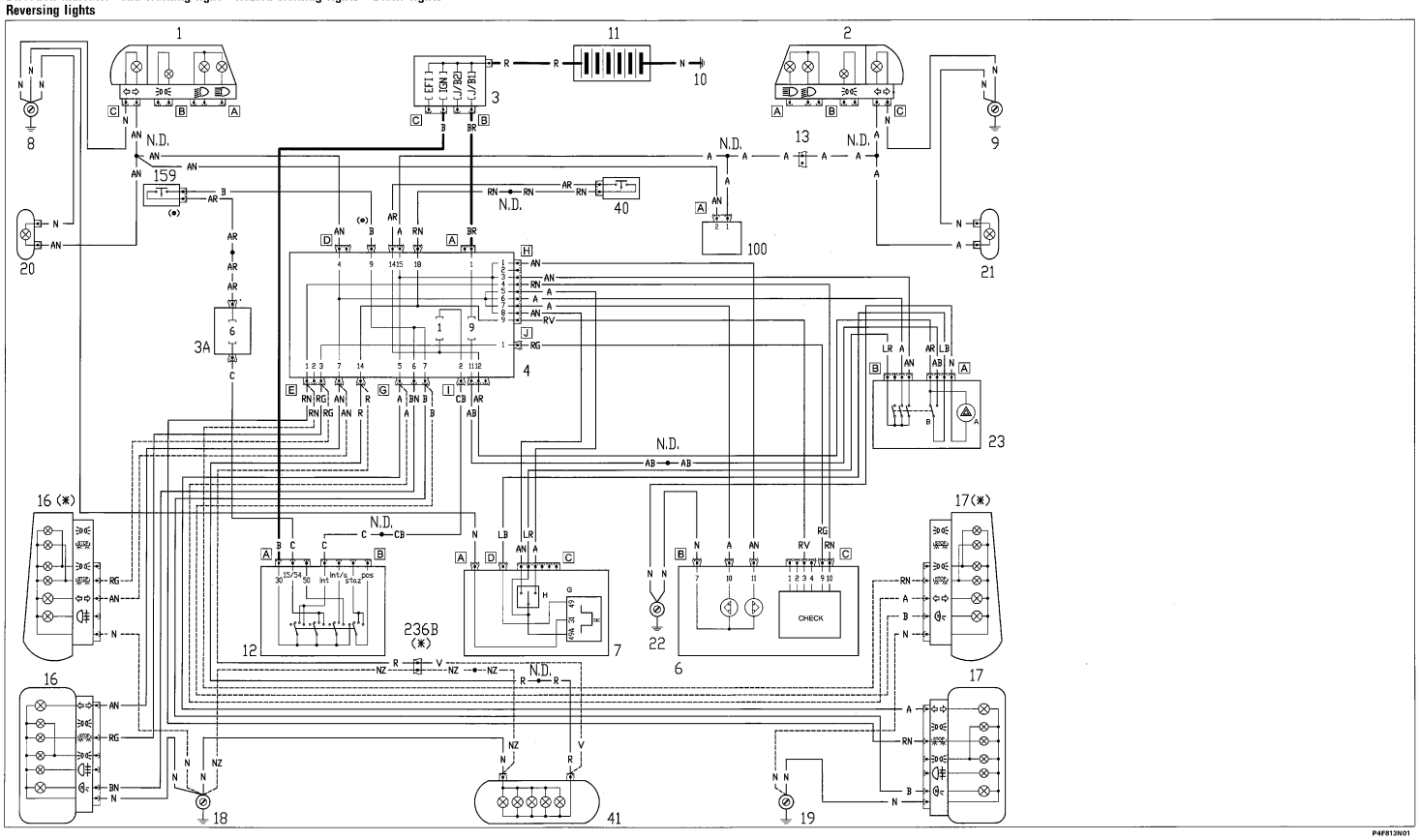
(*) The cables involved in the wiring diagram are marked with an asterisk.



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## 55.

**Versions with Check Panel and alarm**
**Direction indicators and warning light - Hazard warning lights - Brake lights - Reversing lights**




(*) Variants for Marea Weekend

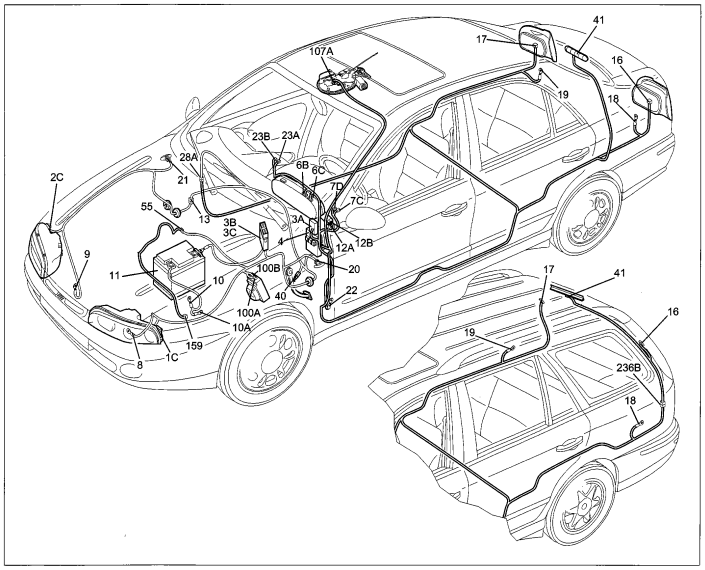
(•) Automatic transmission: see specific wiring diagram

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## 55.



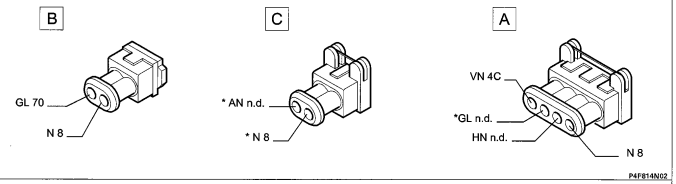

P4F814N01

**Versions with Check Panel and alarm**
**Direction indicators and warning light - Hazard warning lights - Brake lights - Reversing lights**

Key to components

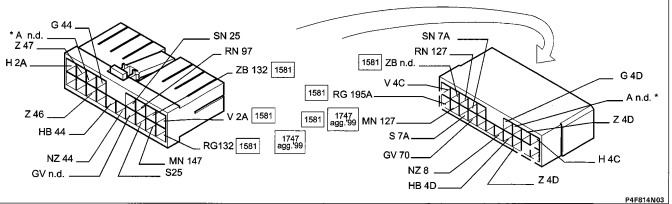
1 Left front light cluster
2 Right front light cluster
3 Power fuse box
4 Junction unit
6 Instrument panel
7 Stalk unit
8 Left front earth
9 Right front earth
10 Battery earth on engine
11 Battery
12 Ignition switch
13 Connection between right/left front cables
16 Left rear light cluster
17 Right rear light cluster
18 Left rear earth
19 Right rear earth
20 Left front side direction indicator
21 Right front side direction indicator
22 Left facia earth
23 Hazard warning lights switch unit
28 Connection between dashboard/rear cables
40 Brake lights control switch
41 Additional brake light
55 Connection between front/engine cables
100 Alarm electronic control unit
107 Central locking remote control receiver
159 Reversing lights control switch
236 Connection between rear cable and tailgate

**1** Left front light cluster



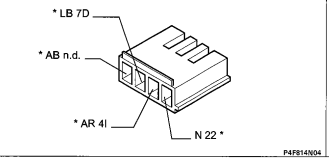

P4F814N02

**13** Connection between right/left front cables



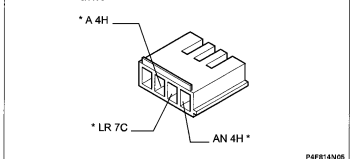

P4F814N03

**23A** Hazard warning lights control switch unit



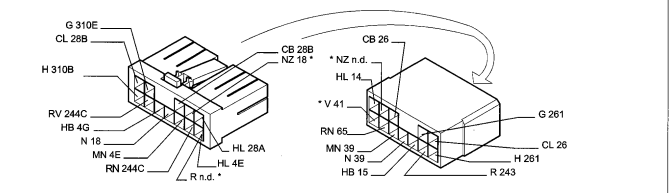

P4F814N04

**23B** Hazard warning lights control switch unit




P4F814N05

**236B** Connection between rear cable and tailgate




Marea Weekend

P4F814N06

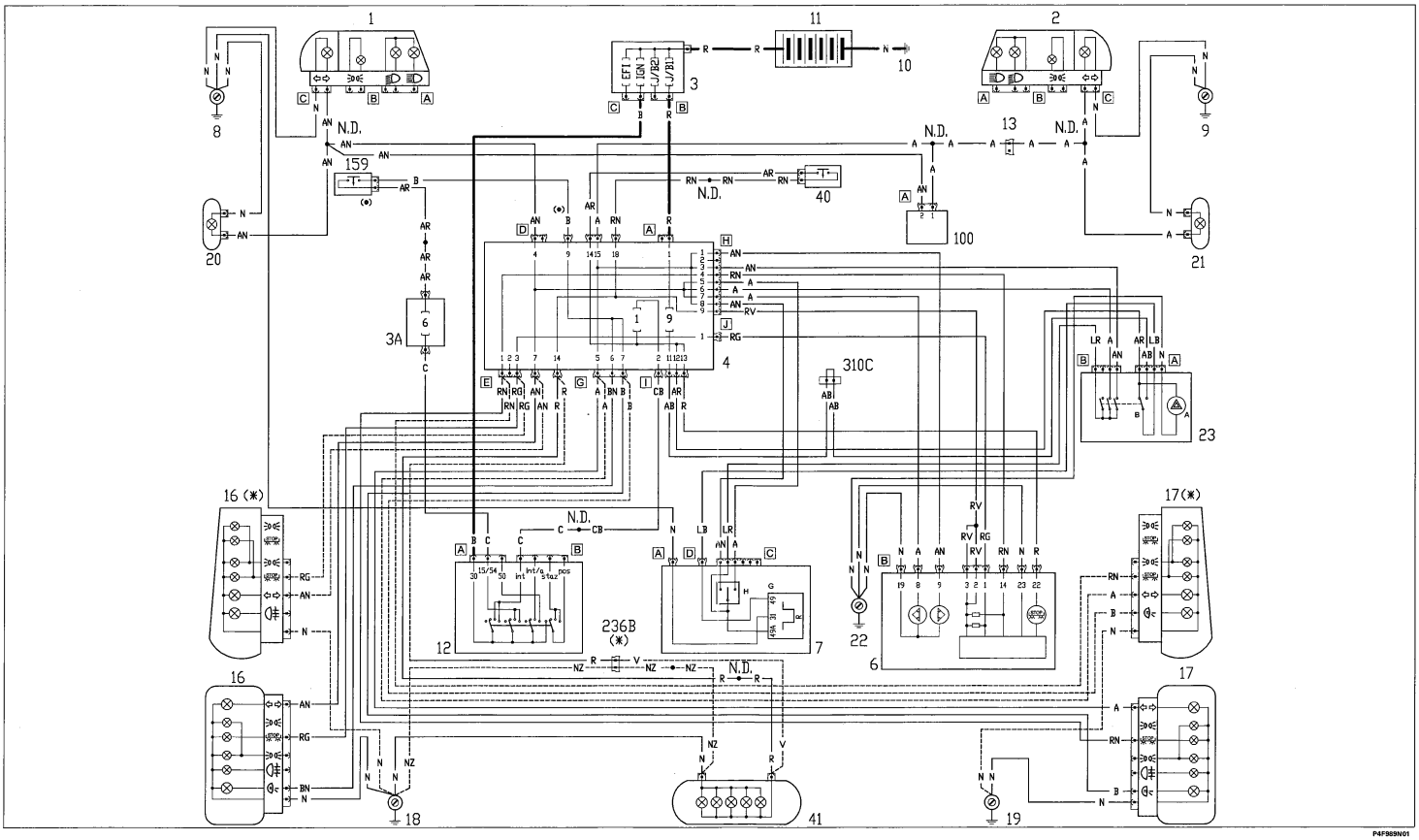
* The cables concerned are marked in the wiring diagram with an asterisk



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## 55.

**Versions with Check Panel and alarm**
**Direction indicators and warning light - Hazard warning lights - Brake lights - Reversing light**



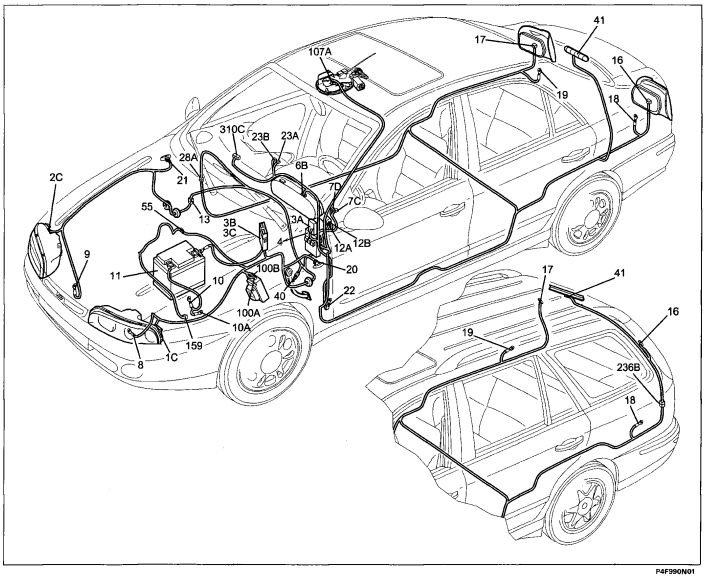

* Variants for Marea Weekend

• Automatic transmission: see specific diagram



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## 55.

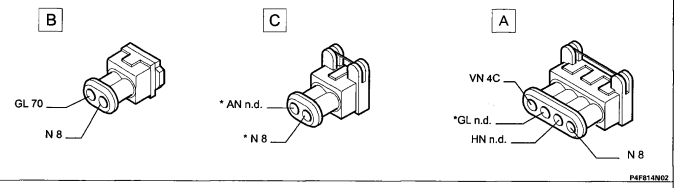



**Versions with Check Panel and alarm**
**Direction indicators and warning light - Hazard warning lights - Brake lights - Reversing light**

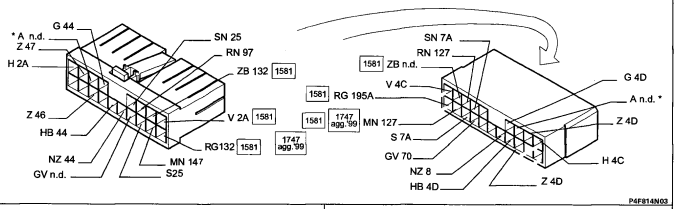
Component key

1 Left front light cluster
2 Right front light cluster
3 power fusebox:
4 Junction unit:
6 Instrument panel
7 Stalk unit
8 Left front earth
9 Right front earth
10 Engine battery earth
11 Battery
12 Ignition switch
13 Connection between right/left front cables
16 Left rear light cluster
17 Right rear light cluster
18 Left rear earth
19 Right rear earth
20 Left front side direction indicator
21 Right front side direction indicator
22 Left facia earth
23 Hazard warning light switch unit
28 Connection between facia/rear cables
40 Brake lights control switch
41 Additional brake light
55 Connection between front/engine cables
100 Alarm electronic control unit
107 Door remote control receiver
159 Reversing light control switch
236 Connection between rear cables and tail-gate
310 Connection bridge

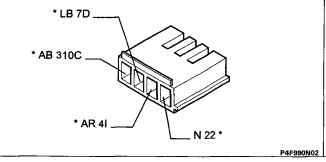
**1** Left front light cluster



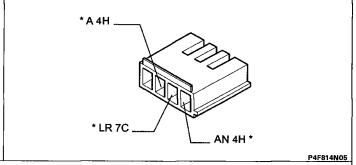

**13** Connection between right/left front cables



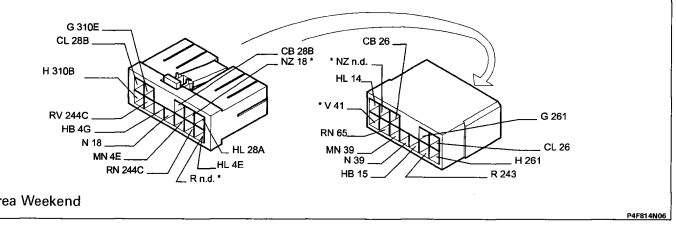

**23A** Hazard warning lights switch unit




**23B** Hazard warning lights switch unit




**236B** Connection betwen rear lead and tail-gate



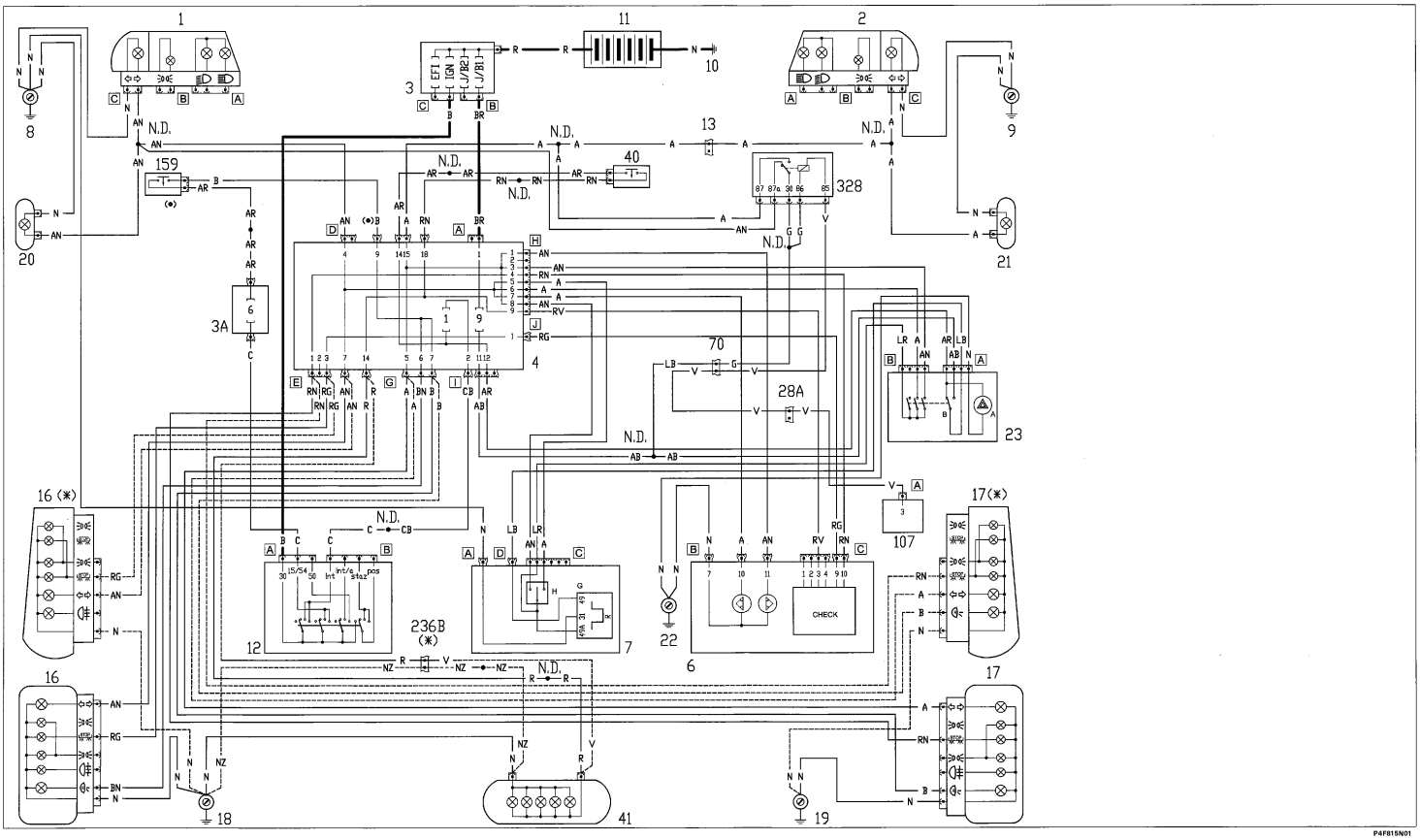

(*) The cables involved in the wiring diagram are marked with an asterisk.



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## 55.

**Versions with Check Panel, without alarm**
**Direction indicators and warning light - Hazard warning lights - Brake lights - Reversing lights**




* Variant for Marea Weekend

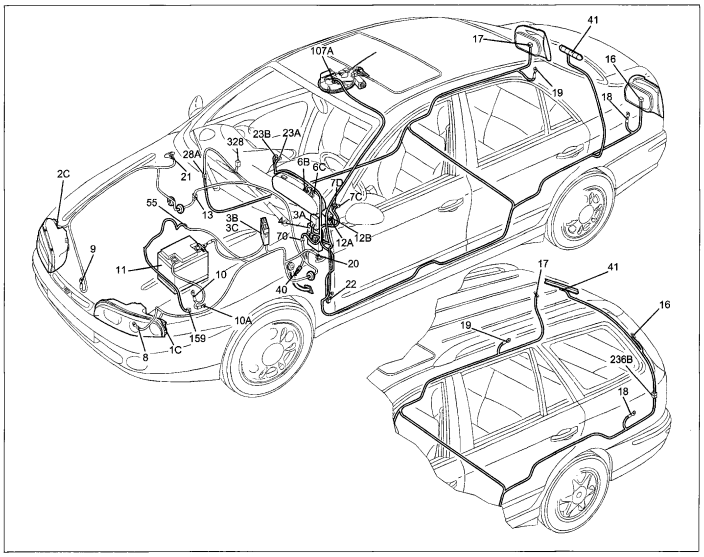
(•) Automatic transmission: see specific wiring diagram

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## 55.



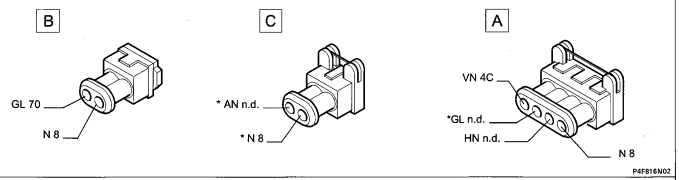

P4F816N01

**Versions with Check Panel, without alarm**
**Direction indicators and warning light - Hazard warning lights - Brake lights - Reversing lights**

Key to components

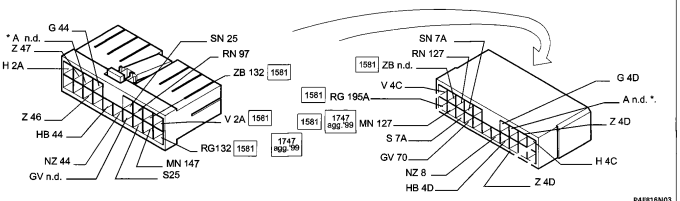
1 Left front light cluster
2 Right front light cluster
3 Power fuse box
4 Junction unit
6 Instrument panel
7 Stalk unit
8 Left front earth
9 Right front earth
10 Battery earth on engine
11 Battery
12 Ignition switch
13 Connection between right/left front cables
16 Left rear light cluster
17 Right rear light cluster
18 Left rear earth
19 Right rear earth
20 Left front side direction indicator
21 Right front side direction indicator
22 Left facia earth
23 Hazard warning lights control switch
28 Connection between dashboard/rear cables
40 Brake lights control switch
41 Additional brake light
55 Connection between front/engine cables
70 Connection between dashboard/front cables
107 Central locking remote control receiver
159 Reversing lights control switch
236 Connection between rear cable and tailgate
328 Hazard warning lights relay

**1** Left front light cluster



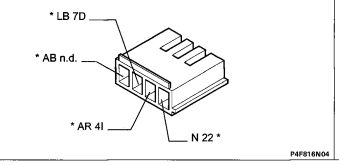

P4F816N02

**13** Connection between right/left front cables



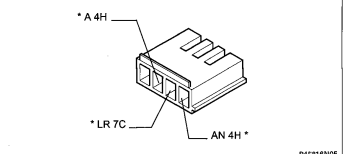

P4F816N03

**23A** Hazard warning lights control switch unit



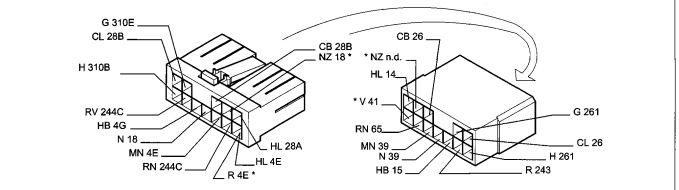

P4F816N04

**23B** Hazard warning lights control switch unit




P4F816N05

**236B** Connection between rear cable and tailgate




Marea Weekend

P4F816N06

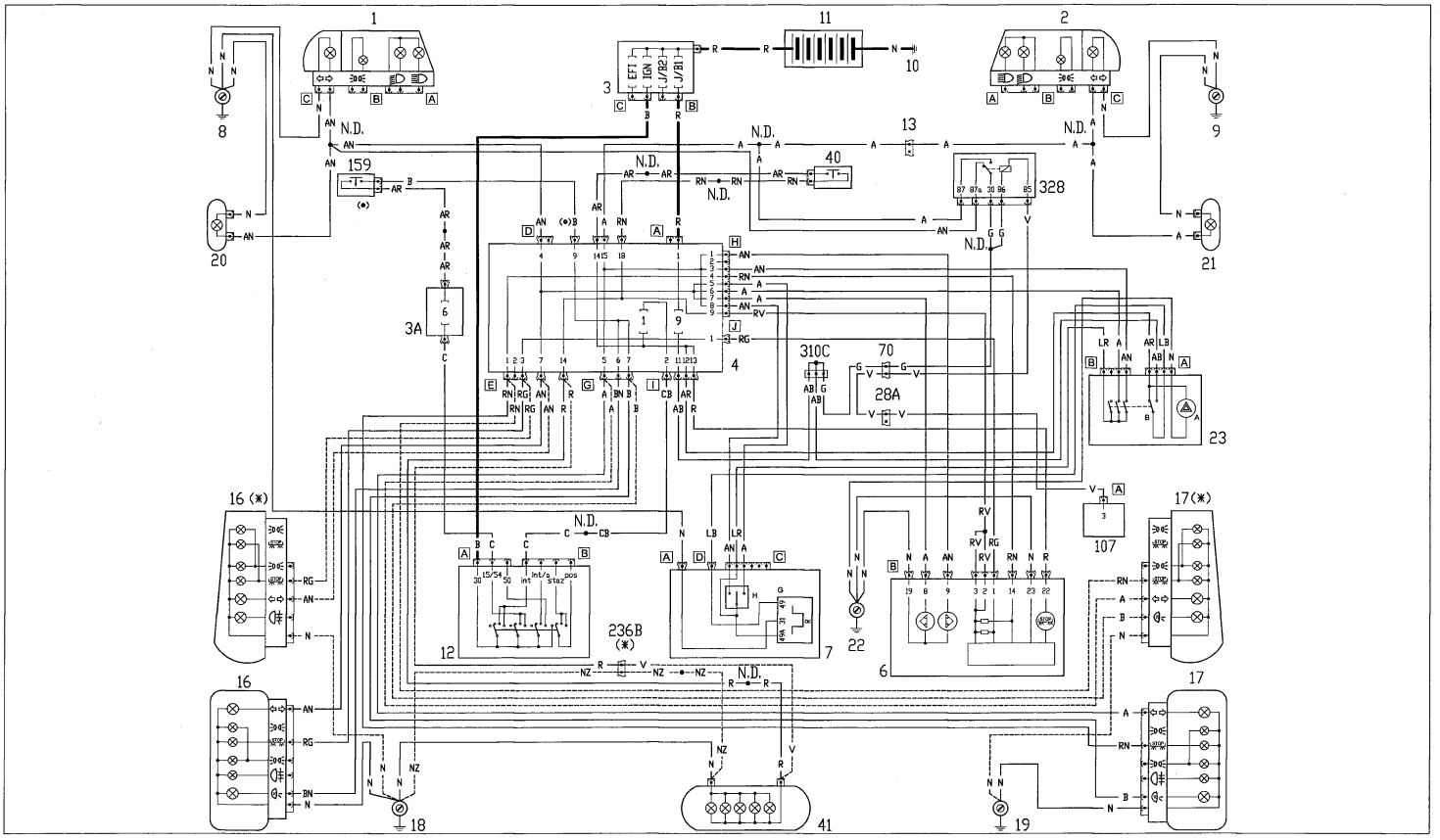
* The cables concerned are marked in the wiring diagram with an asterisk.



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## 55.

**Versions with Check Panel, without alarm**
**Direction indicators and warning light - Hazard warning lights - Brake lights - Reversing light**



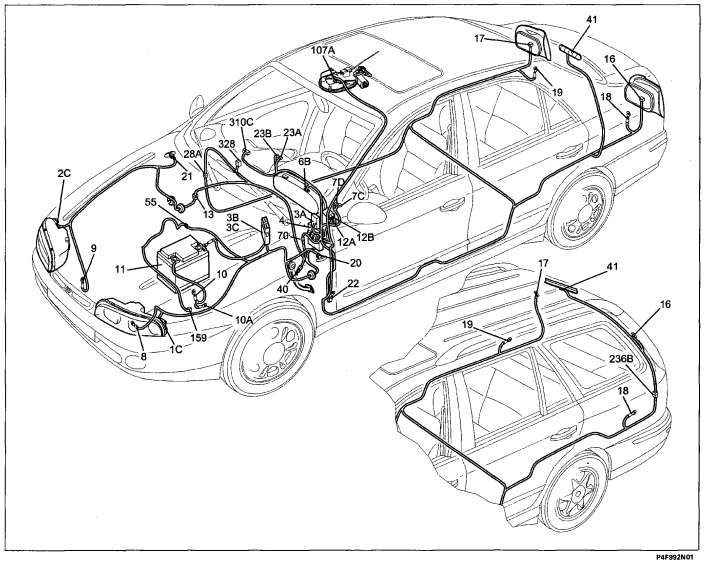

* Variants for Marea Weekend

• Automatic transmission: see specific diagram



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## 55.



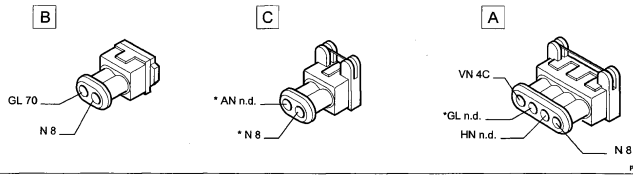

P4F992N01

**Versions with Check Panel, without alarm**
**Direction indicators and warning light - Hazard warning lights - Brake lights - Reversing light**

Component key

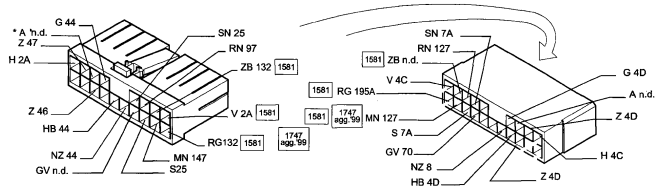
1 Left front light cluster
2 Right front light cluster
3 Power fusebox
4 Junction unit
6 Instrument panel
7 Stalk unit
8 Left front earth
9 Right front earth
10 Engine battery earth
11 Battery
12 Ignition switch
13 Connection between right/left front cables
16 Left rear light cluster
17 Right rear light cluster
18 Left rear earth
19 Right rear earth
20 Left front side direction indicator
21 Right front side direction indicator
22 Left facia earth
23 Hazard warning light switch unit
28 Connection between facia/rear cables
40 Brake lights control switch
41 Additional brake light
55 Connection between front/engine cables
70 Connection between dashborad/front cables
100 Alarm electronic control unit
107 Door remote control receiver
159 Reversing light control switch
236 Connection between rear cables and tail-gate
310 Connection bridge
328 Hazard warning light relay

**1** Left front light cluster



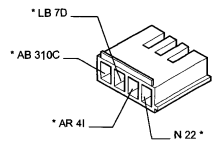

P4F816N02

**13** Connection between right/left front cables



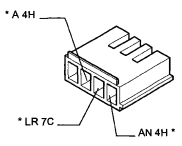

P4F816N03

**23A** Hazard warning lights switch unit



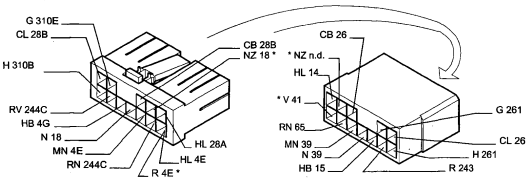

P4F992N02

**23B** Hazard warning lights switch unit




P4F816N05

**236B** Connection betwen rear lead and tail-gate




Marea Weekend

P4F816N06

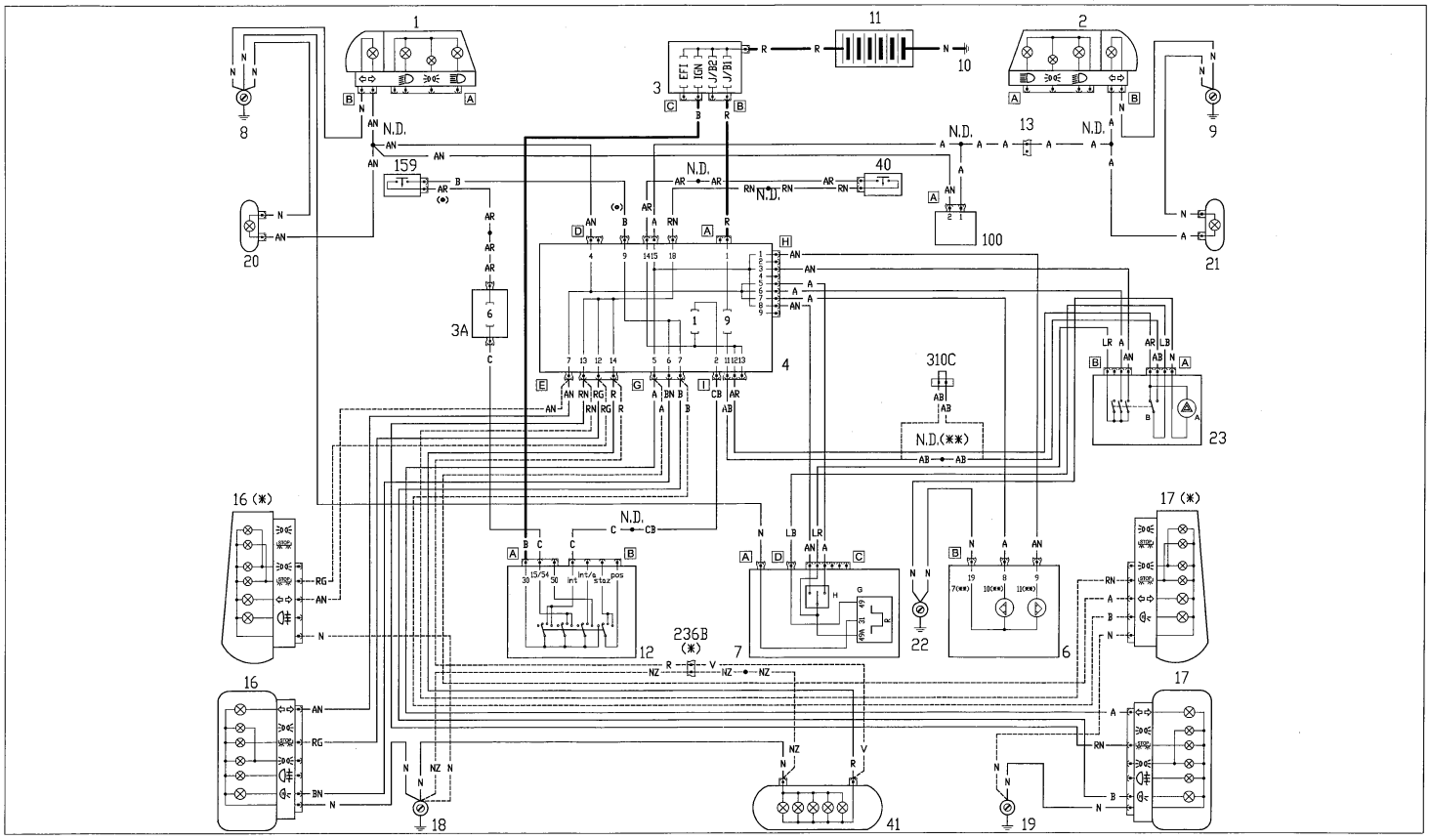
(*) The cables involved in the wiring diagram are marked with an asterisk.



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# 55.

**Versions without Check Panel, with alarm**
**Direction indicators and warning light - Hazard warning lights - Brake lights - Reversing light**




* Variant for Marea Weekend

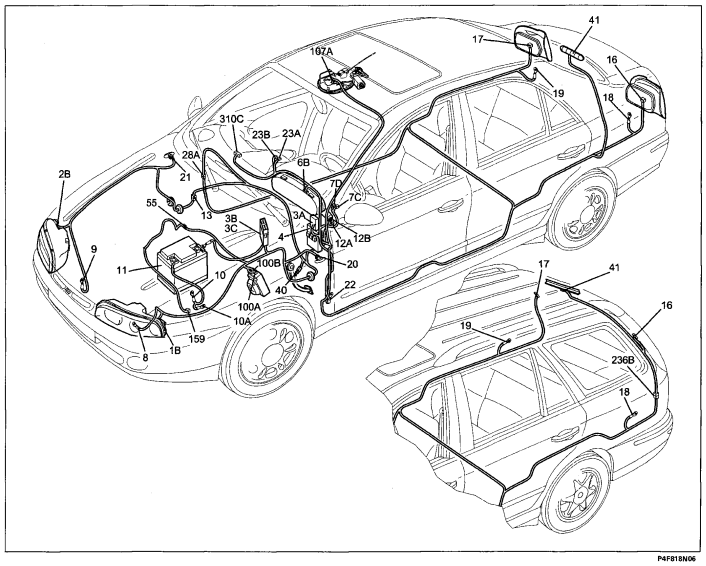
** Variant up to Nov. '99

• Automatic transmission: see specific diagram



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## 55.



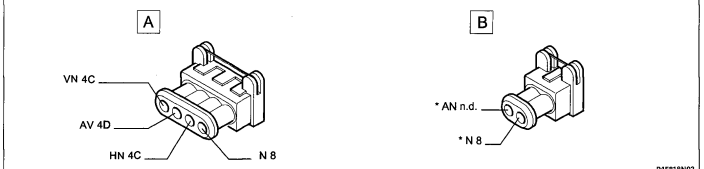

P4F818N06

**Versions without Check Panel, with alarm**
**Direction indicators and warning light - Hazard warning lights - Brake lights - Reversing light**

Component key

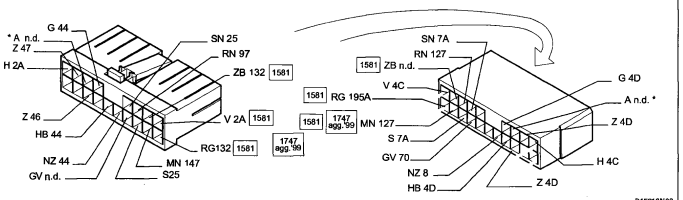
1 Left front light cluster
2 Right front light cluster
3 power fusebox:
4 Junction unit:
6 Instrument panel
7 Stalk unit
8 Left front earth
9 Right front earth
10 Engine battery earth
11 Battery
12 Ignition switch
13 Connection between right/left front cables
16 Left rear light cluster
17 Right rear light cluster
18 Left rear earth
19 Right rear earth
20 Left front side direction indicator
21 Right front side direction indicator
22 Left facia earth
23 Hazard warning light switch unit
28 Connection between facia/rear cables
40 Brake lights control switch
41 Additional brake light
55 Front/engine lead connection
100 Alarm electronic control unit
107 Door remote control receiver
159 Reversing light control switch
236 Connection between rear cables and tail-gate
310 Connection bridge

**1** Left front light cluster



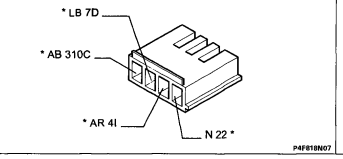

P4F818N02

**13** Connection between right/left front cables



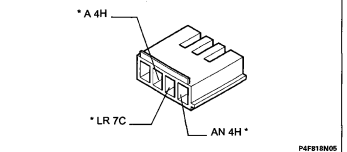

P4F818N03

**23A** Hazard warning lights switch unit



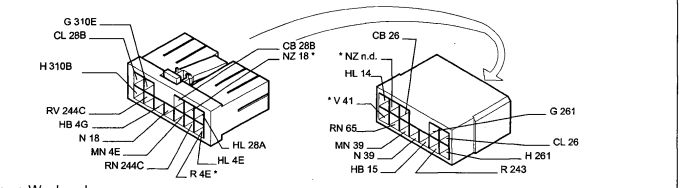

P4F818N07

**23B** Hazard warning lights switch unit




P4F818N05

**236B** Connection betwen rear lead and tail-gate




Marea Weekend

P4F806N05

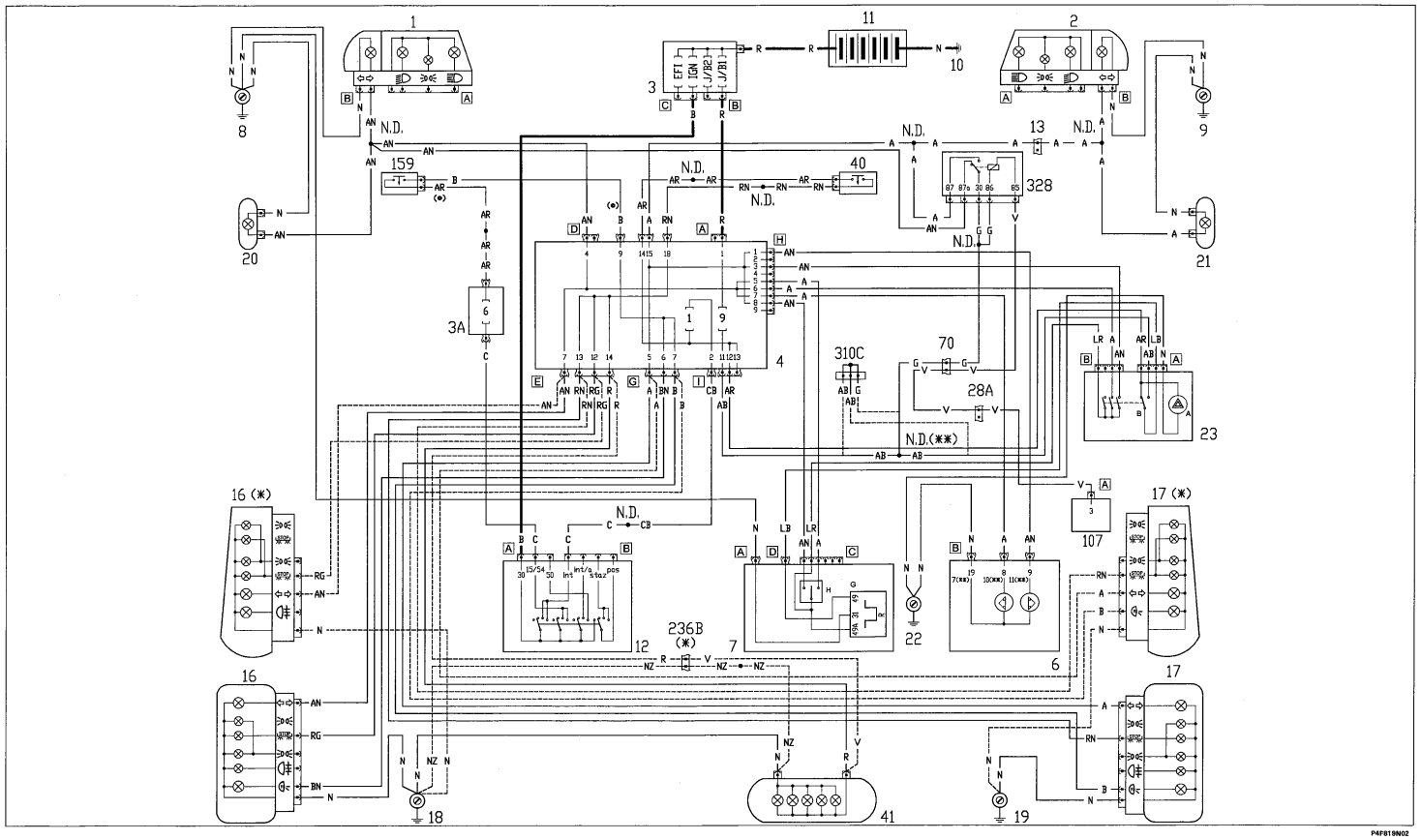
(*) The cables involved in the wiring diagram are marked with an asterisk.



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## 55.

**Versions without Check Panel, without alarm**
**Direction indicators and warning light - Hazard warning lights - Brake lights - Reversing light**




* Variant for Marea Weekend

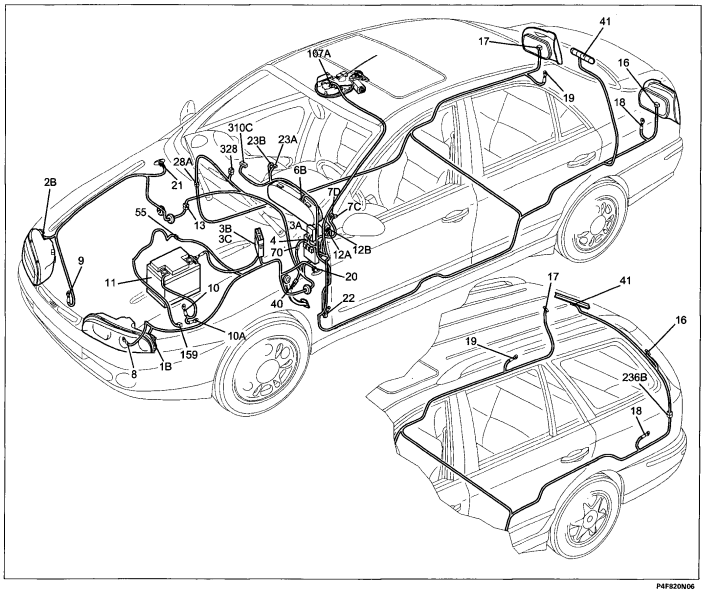
** Variant up to Nov. '99

• Automatic transmission: see specific diagram



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## 55.

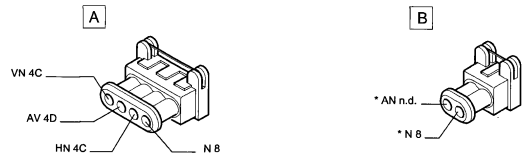



**Versions without Check Panel, without alarm**
**Direction indicators and warning light - Hazard warning lights - Brake lights - Reversing light**

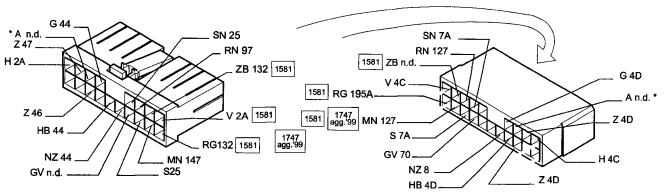
Component key

1 Left front light cluster
2 Right front light cluster
3 power fusebox:
4 Junction unit:
6 Instrument panel
7 Stalk unit
8 Left front earth
9 Right front earth
10 Engine battery earth
11 Battery
12 Ignition switch
13 Connection between right/left front cables
16 Left rear light cluster
17 Right rear light cluster
18 Left rear earth
19 Right rear earth
20 Left front side direction indicator
21 Right front side direction indicator
22 Left facia earth
23 Hazard warning light control switch unit
28 Connection between facia/rear cables
40 Brake lights control switch
41 Additional brake light
55 Front/engine lead connection
70 Connection between dashborad/front cables
107 Door remote control receiver
159 Reversing light control switch
236 Connection between rear cables and tail-gate
310 Connection bridge
328 Hazard warning light relay

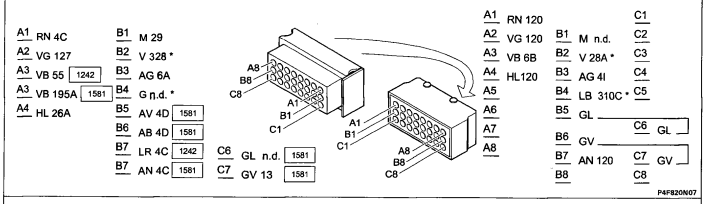
### 1 Left front light cluster



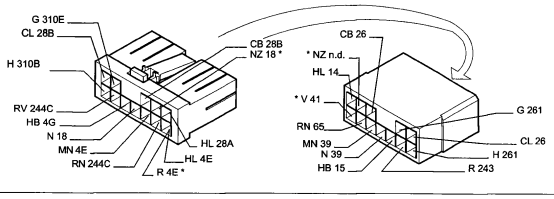

### 13 Connection between right/left front cables




### 70 Connection between dashborad/front cables




### 236B Connection betwen rear lead and tail-gate



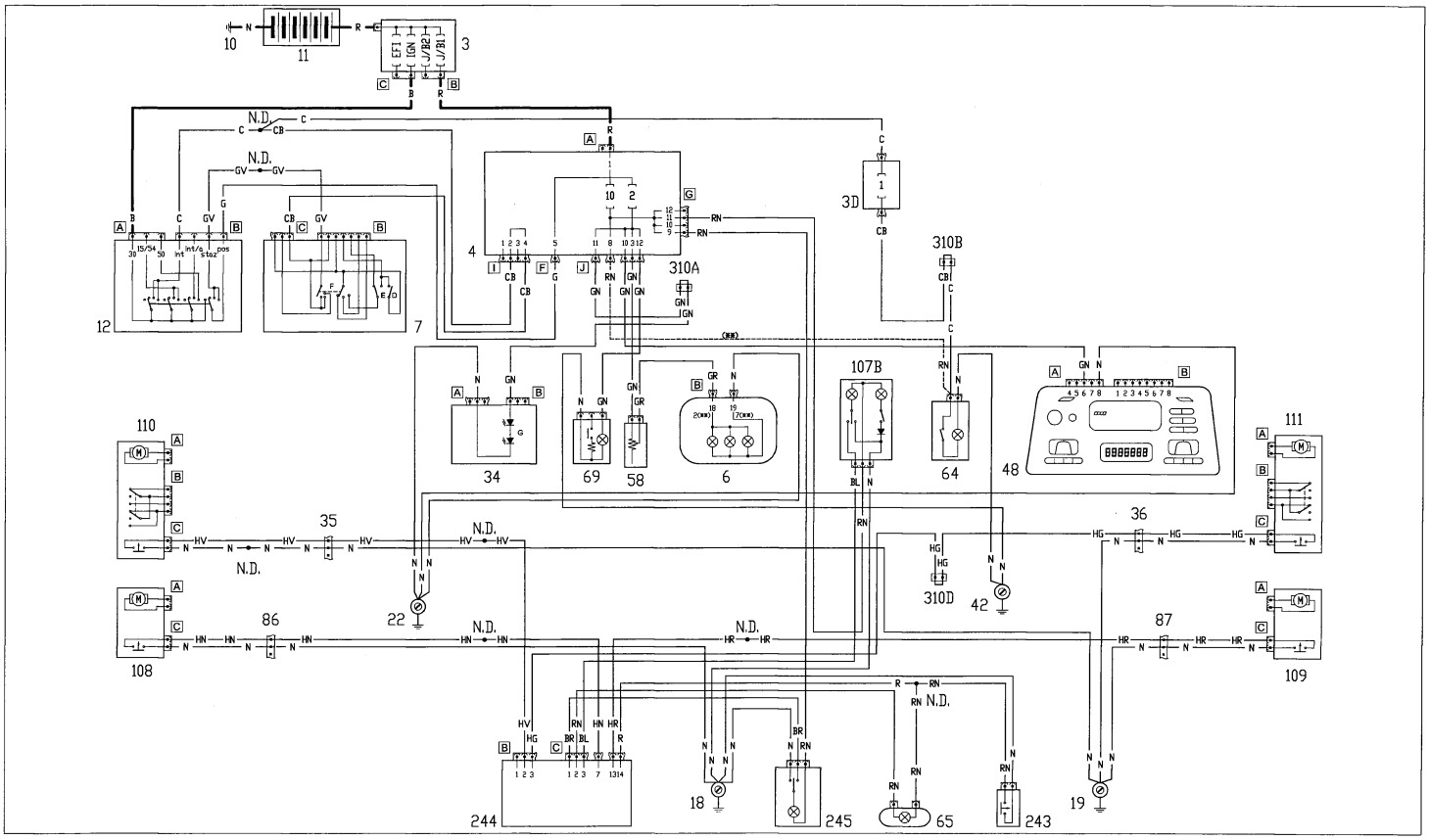

(*) The cables involved in the wiring diagram are marked with an asterisk.



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## 55.

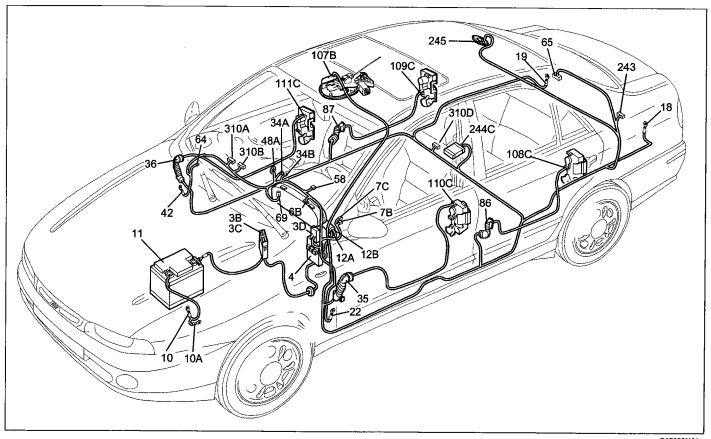
**Fiat Marea**
**Car interior lighting - Symbol lighting**




** Variant up to Nov. '99



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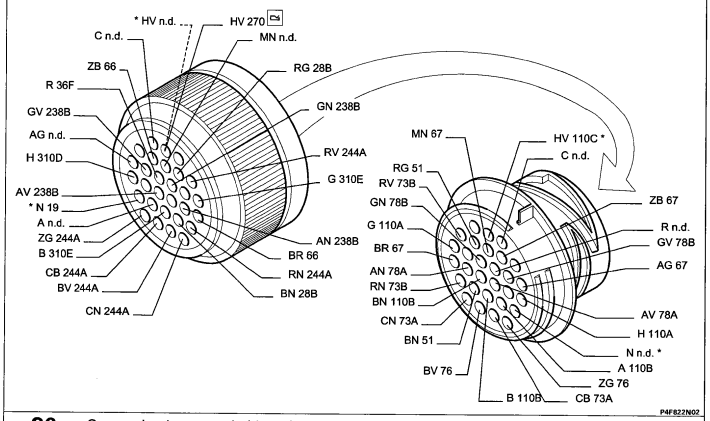



**Fia Marea**
**Car interior ghting - Symbol lighting**

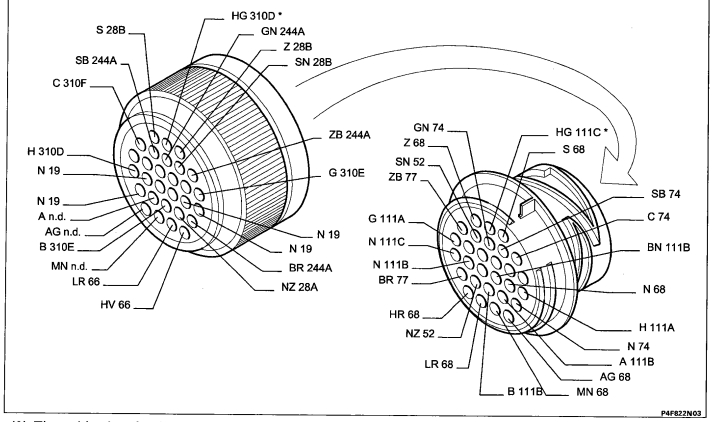
Component key

3 power fusebox:
4 Junction unit:
6 Instrument panel
7 Stalk unit
10 Engine battery earth
11 Battery
12 Ignition switch
18 Left rear earth
19 Right rear earth
22 Left facia earth
34 Switch control unit
35 Connection between dashboard/left front door cables
36 Connection between dashboard/right front door cables
42 Right facia earth
48 Radio receiver with clock
58 Control panel light dimmer
64 Glove compartment light bulb with built-in switch
65 Luggage compartment light
69 Cigar lighter
86 Connection between rear/left rear door cables
87 Connection between rear/right rear door cables
107 Door remote control receiver
108 Left rear door lock
109 Right rear door lock
110 Left front door lock
111 Right front door lock
243 Luggage compartment light button
244 Integrated services control system
245 Rear courtesy light
310 Connection bridge

**35** Connection between dashboard/left front door cables




**36** Connection between dashboard/right front door cables

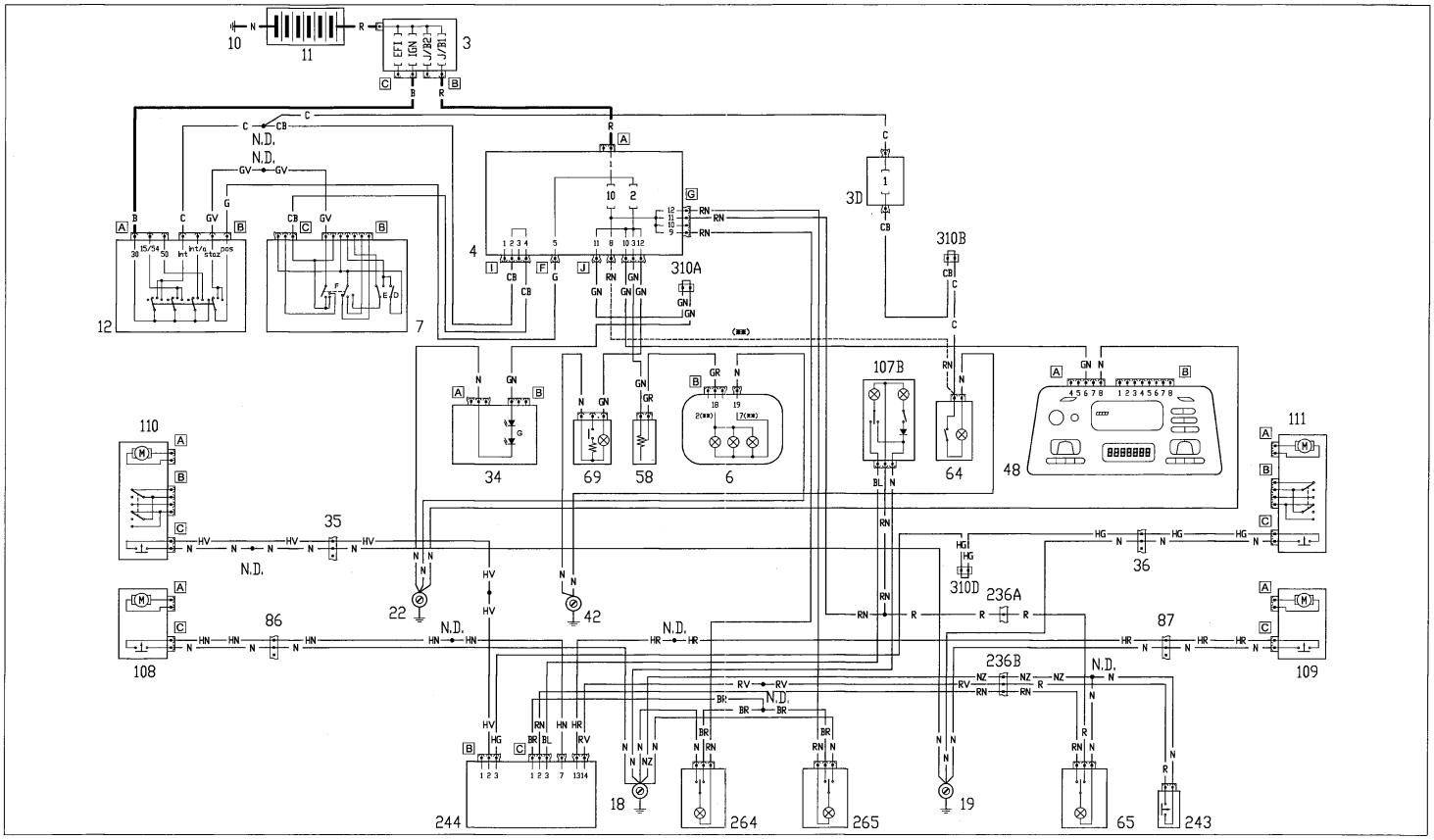



(*) The cables involved in the wiring diagram are marked with an asterisk.



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**Fiat Marea Weekend**
**Car interior lighting - Symbol lighting**

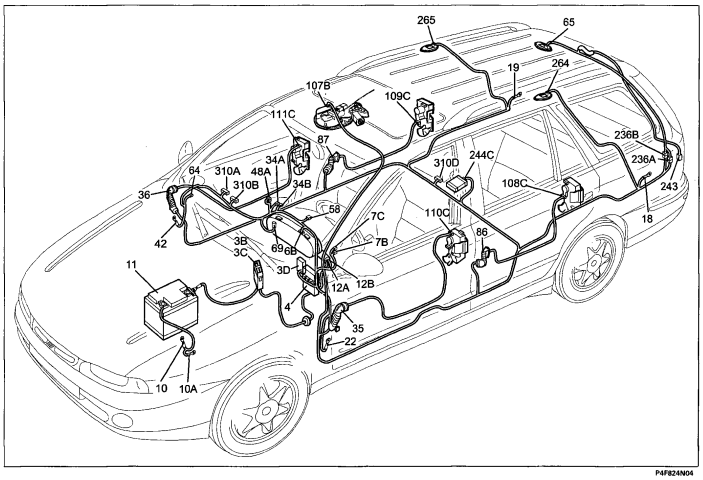



** Variant up to Nov. '99



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## 55.

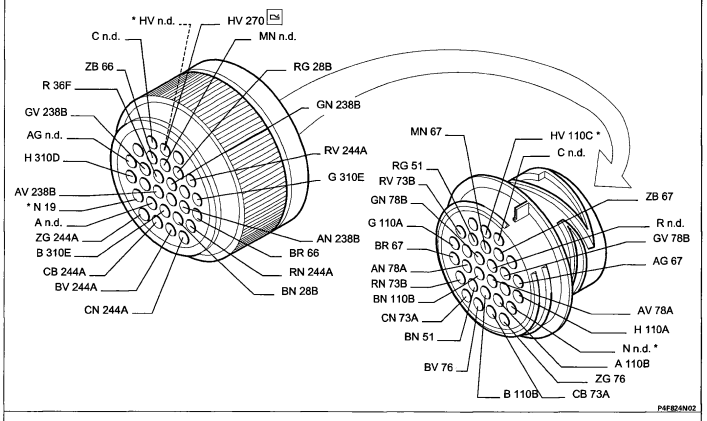



**Fiat Marea Weekend**
**Car interior ghting - Symbol lighting**

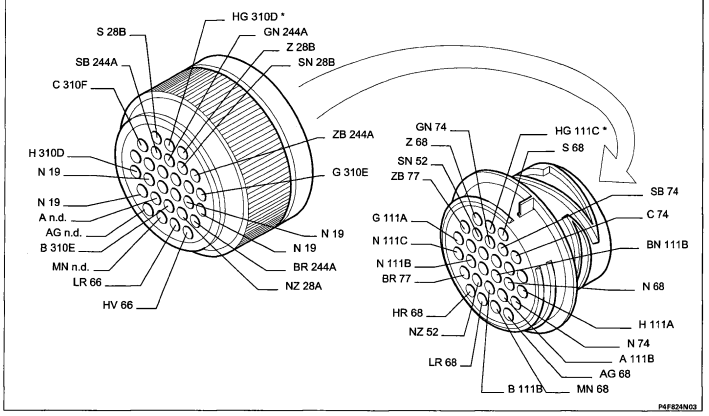
Component key

3 power fusebox:
4 Junction unit:
6 Instrument panel
7 Stalk unit
10 Engine battery earth
11 Battery
12 Ignition switch
18 Left rear earth
19 Right rear earth
22 Left facia earth
34 Switch control unit
35 Connection between dashboard/left front door cables
36 Connection between dashboard/right front door cables
42 Right facia earth
48 Radio receiver with clock
58 Control panel light dimmer
64 Glove compartment light bulb with built-in switch
65 Luggage compartment light
69 Cigar lighter
86 Connection between rear/left rear door cables
87 Connection between rear/right rear door cables
107 Door remote control receiver
108 Left rear door lock
109 Right rear door lock
110 Left front door lock
111 Right front door lock
236 Connection between rear cables and tailgate
243 Luggage compartment light button
244 Integrated services control system
264 Left rear car interior courtesy light
265 Right rear car interior courtesy light
310 Connection bridge

**35** Connection between dashboard/left front door cables




**36** Connection between dashboard/right front door cables



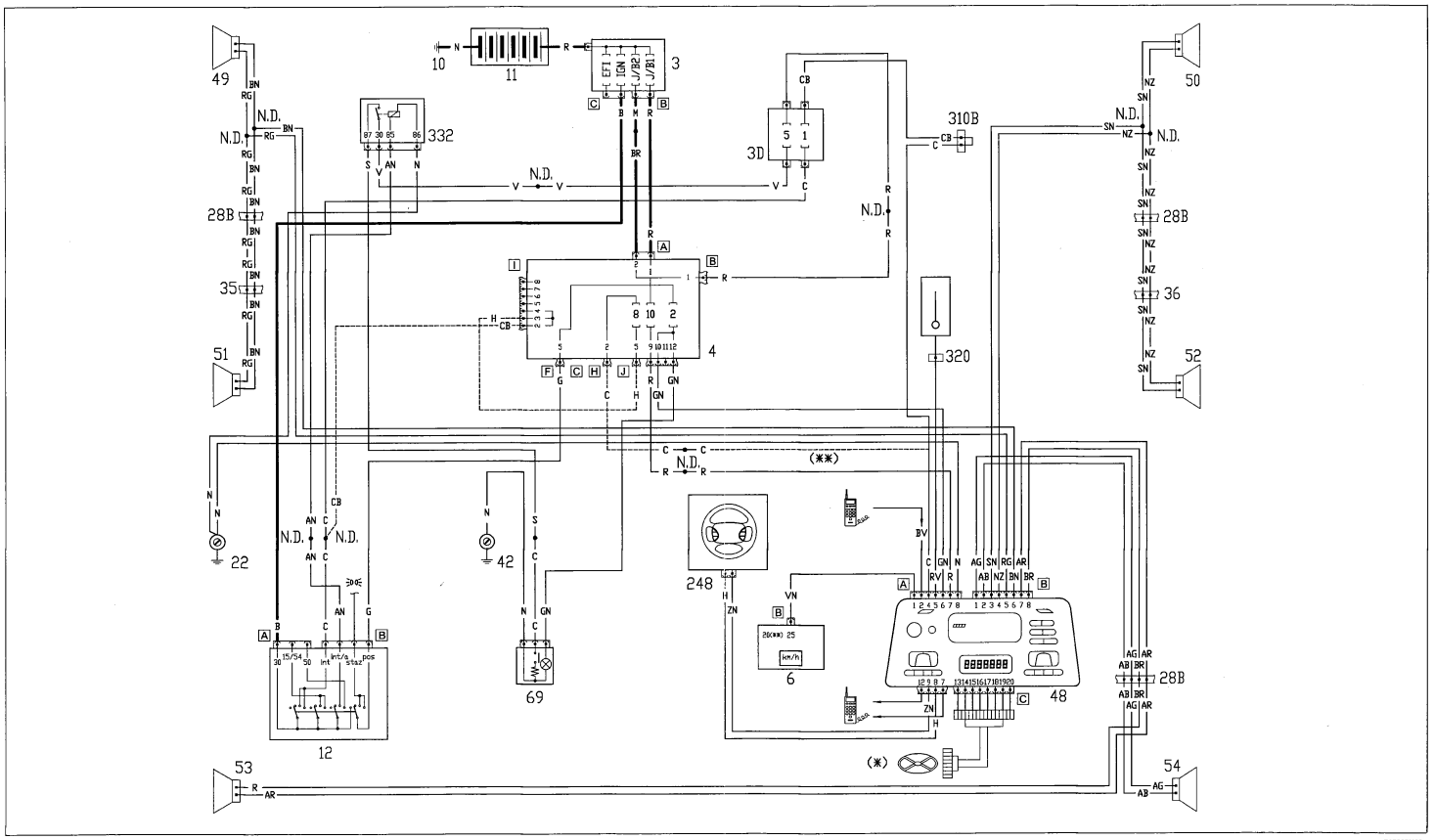

(*) The cables involved in the wiring diagram are marked with an asterisk.



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## 55.

**Radio system (high level: AD 185 H) – Cigarette lighter**



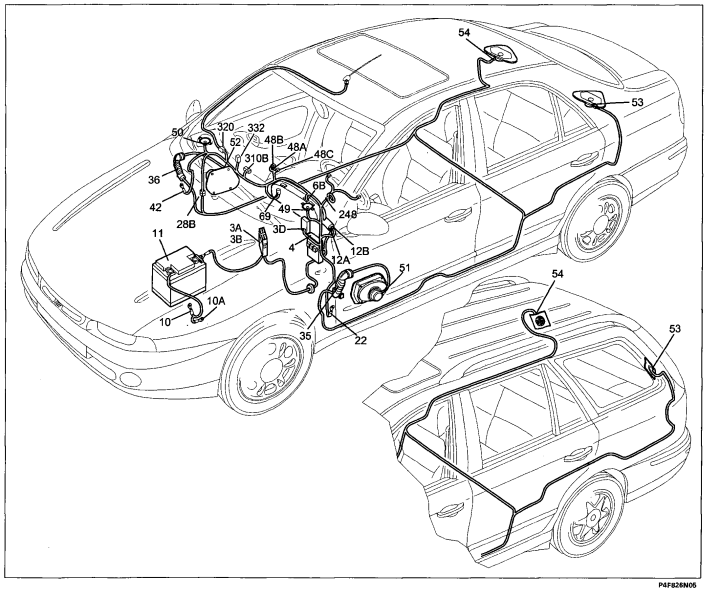

(*) Predisposition for CD

(**) Variant up to Nov. '99



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## 55.

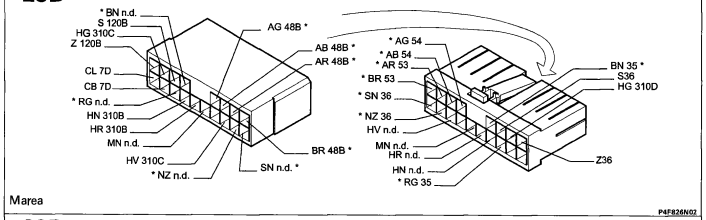



**Radio system (high level: AD 185 H) - Cigarette lighter**

Component key

3 power fusebox:
4 Junction unit:
6 Instrument panel
10 Engine battery earth
11 Battery
12 Ignition switch
22 Left facia earth
28 Connection between facia/rear cables
35 Connection between dashboard/left front door cables
36 Connection between dashboard/right front door cables
42 Right facia earth
48 Radio receiver with clock
49 Left front tweeter speaker
50 Right front tweeter speaker
51 Speaker in left front door
52 Speaker in right front door
53 Left rear speaker
54 Right rear speaker
69 Cigar lighter
248 Radio controls on steering wheel
310 Connection bridge
320 Aerial power supply
321 Connection for TELEPASS

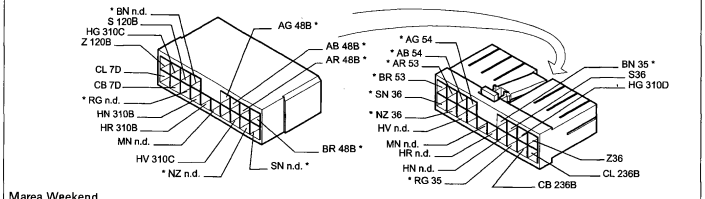
**28B** Facia/rear lead connection




Marea

P4F826N02

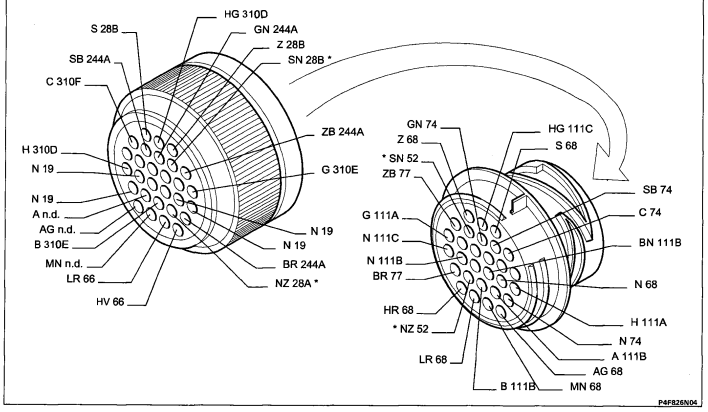
**28B** Facia/rear lead connection




Marea Weekend

P4F826N03

**36** Connection between dashboard/right front door cables




P4F826N04

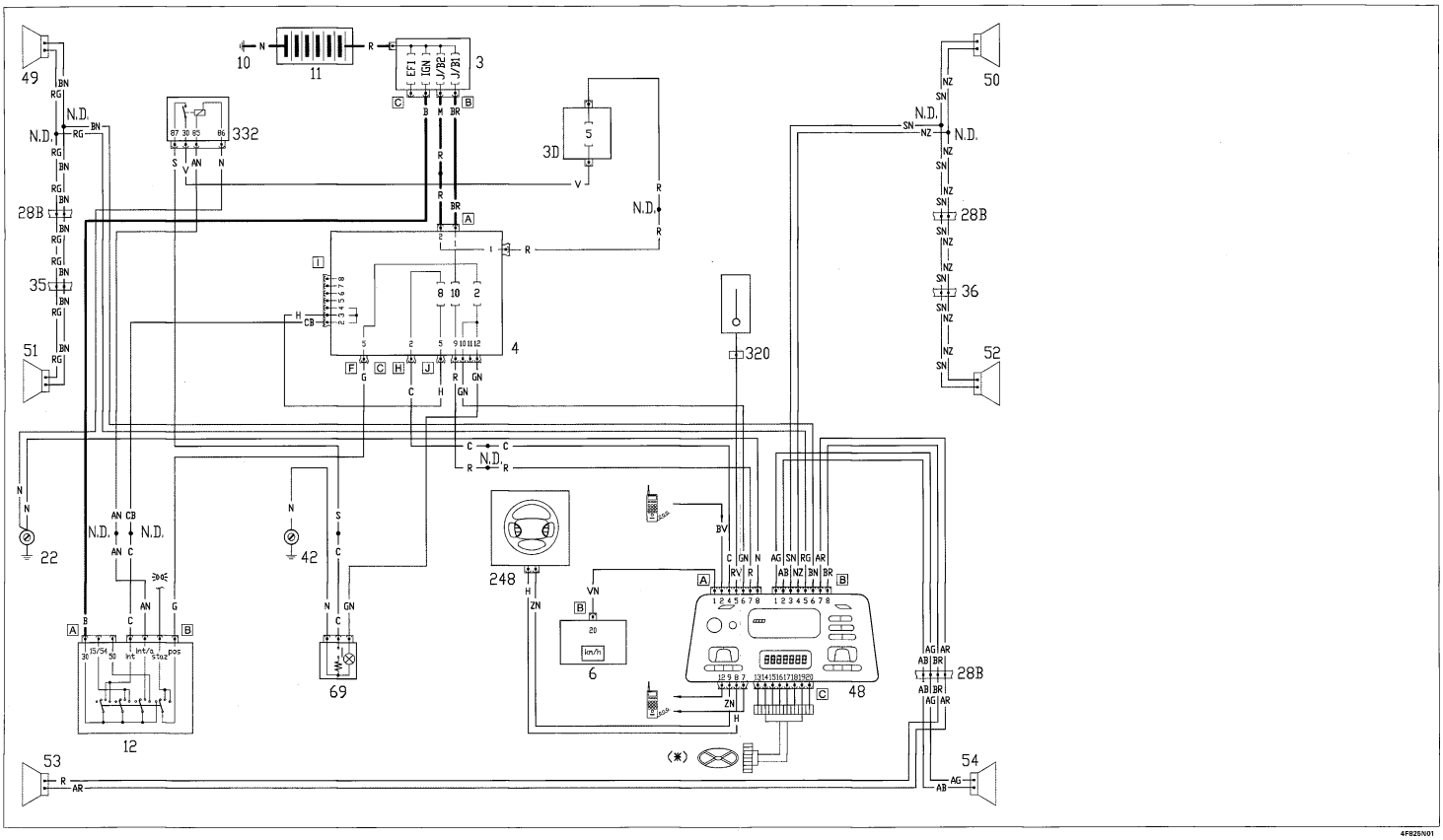
(*) The cables involved in the wiring diagram are marked with an asterisk.



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## 55.

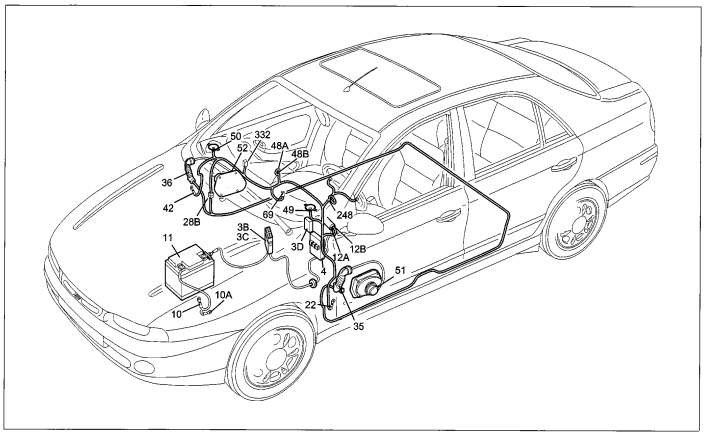
**Radio system (middle of the range: AD 185 M) - Cigar lighter**




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P4F828N01

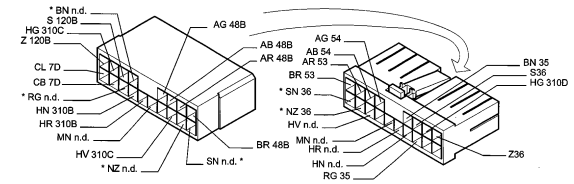
**Radio system (middle of the range: AD 185 M) - Cigar lighter**

Key to components

| | |
|---|---|
| 3 | Direction indicator |
| 4 | Junction unit |
| 10 | Battery earth on engine |
| 11 | Battery |
| 12 | Ignition switch |
| 22 | Left facia earth |
| 28 | Connection between dashboard/rear cables |
| 35 | Connection between dashboard/left front door cables |
| 36 | Connection between dashboard/right front door cables |
| 42 | Right dashboard earth |
| 48 | Radio receiver with clock |
| 49 | Left front speaker (tweeter) |
| 50 | Right front speaker (tweeter) |
| 51 | Speaker in left front door |
| 52 | Speaker in right front door |
| 69 | Cigar lighter |
| 248 | Radio controls on steering wheel |
| 332 | Power relay controlled by ignition |

## 55.

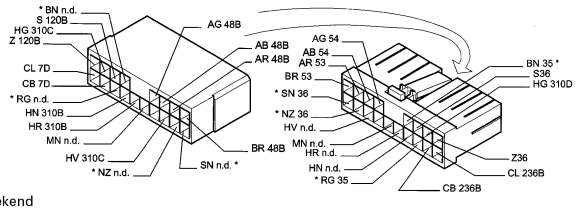
**28B** Connection between dashboard/rear cables




Marea

P4F828N02

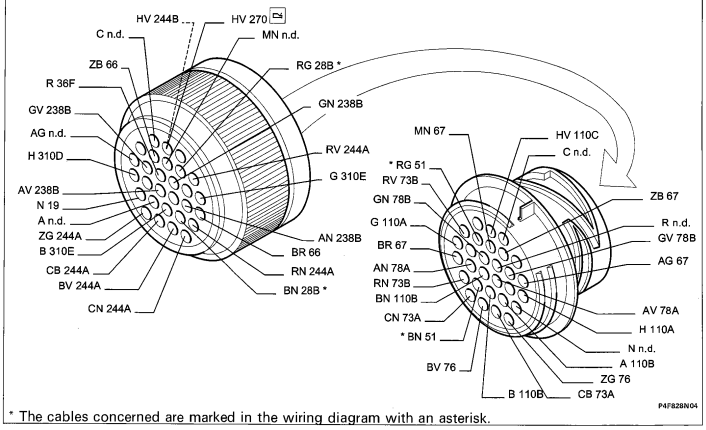
**28B** Connection between dashboard/rear cables




Marea Weekend

P4F828N03

**35** Connection between dashboard/left front door cables




P4F828N04

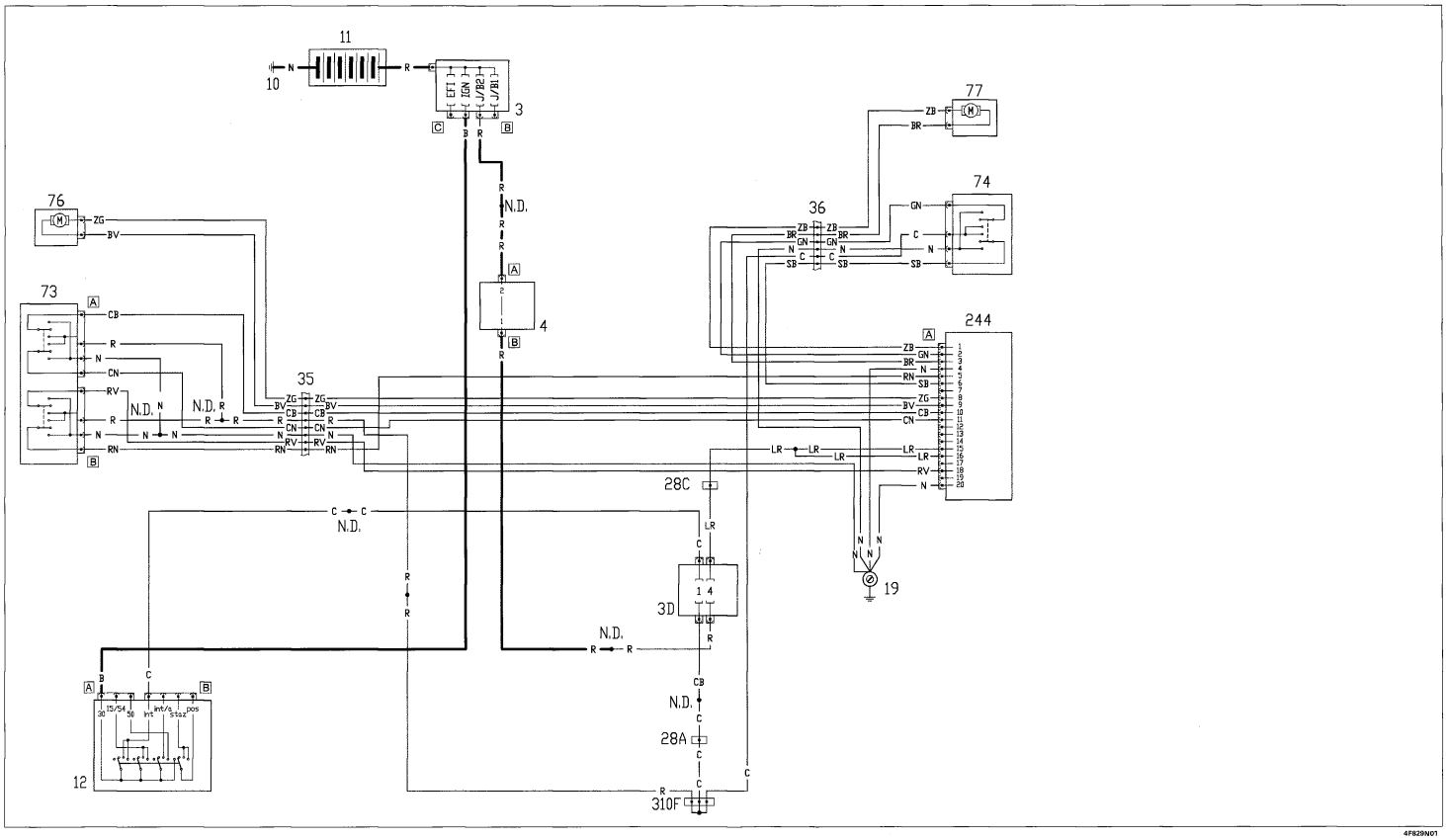
* The cables concerned are marked in the wiring diagram with an asterisk.



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## 55.

**Electric front windows**



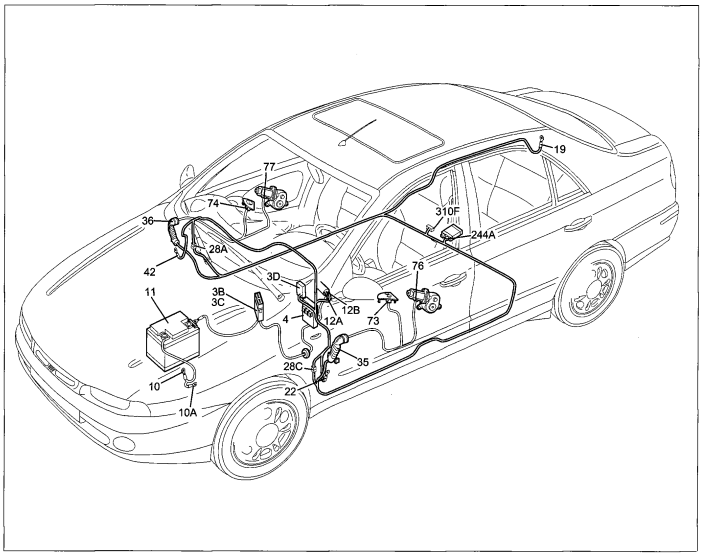

4FB29N01

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## 55.



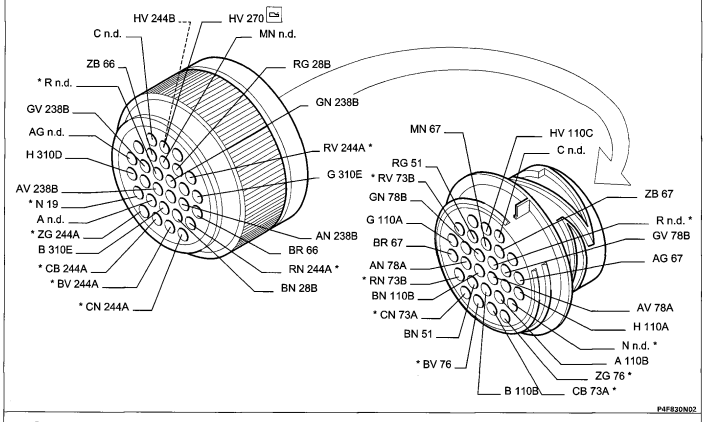

P4F830N01

**Electric front windows**

Key to components

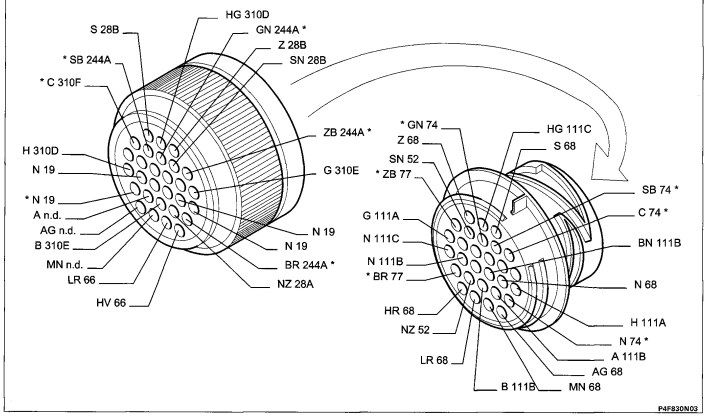
3 Direction indicator
4 Junction unit
10 Battery earth on engine
11 Battery
12 Ignition switch
19 Right rear earth
22 Left facia earth
28 Connection between dashboard/rear cables
35 Connection between dashboard/left front door cables
36 Connection between dashboard/right front door cables
42 Right dashboard earth
73 Control panel for front electric windows on left armrest
74 Control panel for right electric front window on right armrest
76 Left front electric window motor
77 Right front electric window motor
244 Integrated services electronic control unit
310 Connecting bridge

**35** Connection between dashboard/left front door cables




P4F830N02

**36** Connection between dashboard/right front door cables




P4F830N03

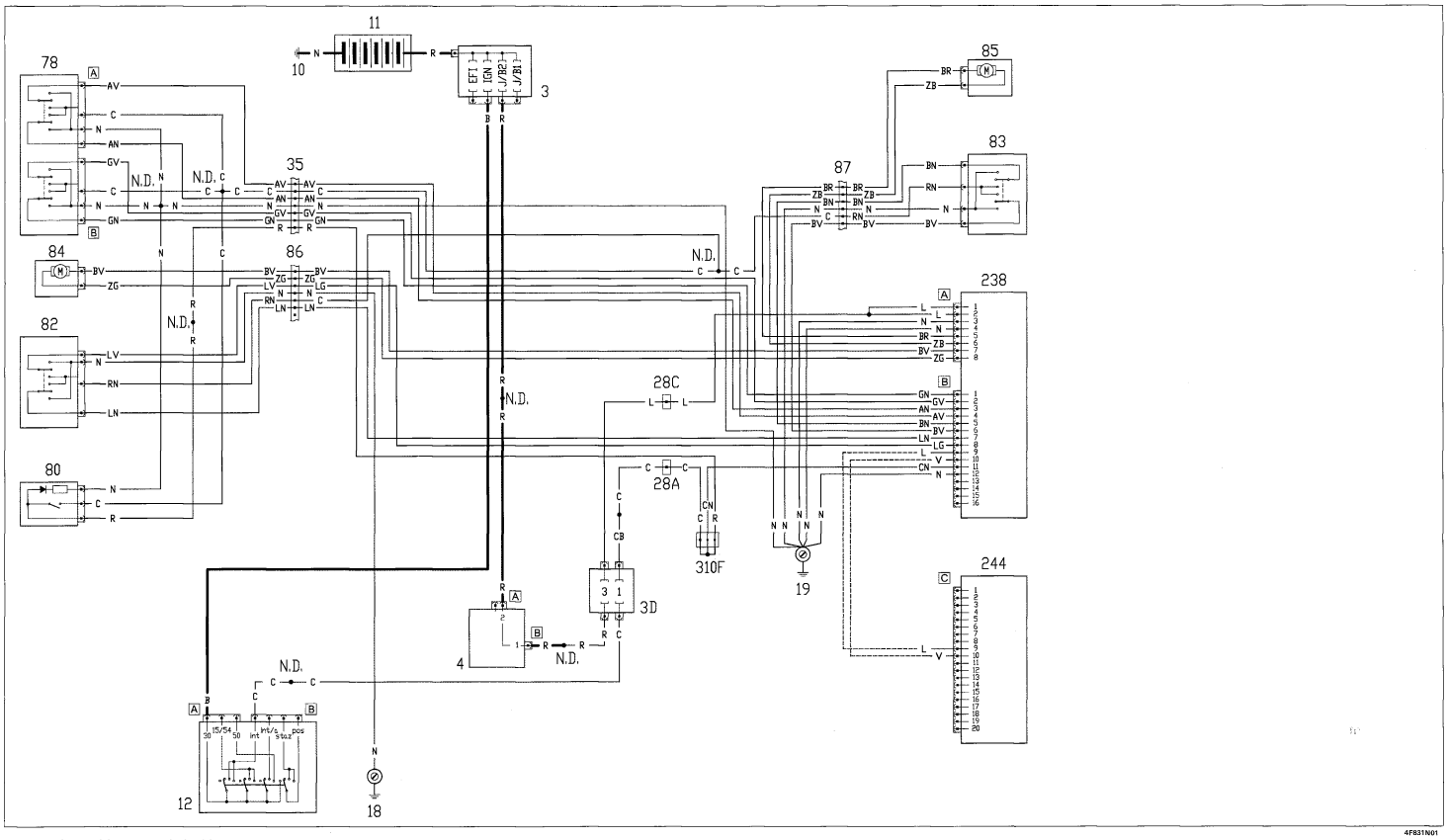
* The cables concerned are marked in the wiring diagram with an asterisk.



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## 55.

**Electric rear windows**



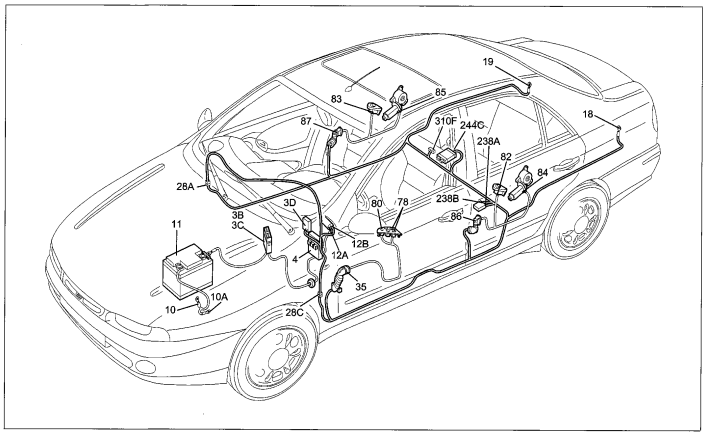

4FB31N01

--- Versions with automatic locking



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## 55.



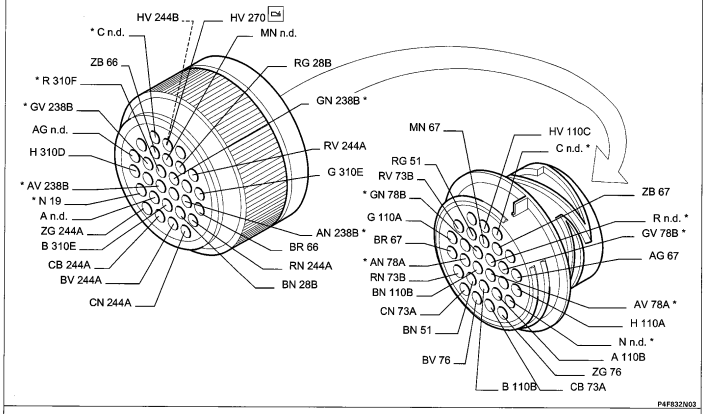

P4F832N01

**Electric rear windows**

Key to components

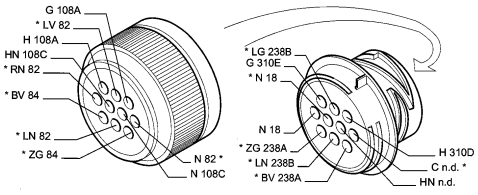
3 Direction indicator
4 Junction unit
10 Battery earth on engine
11 Battery
12 Ignition switch
18 Left rear earth
19 Right rear earth
28 Connection between dashboard/rear cables
35 Connection between dashboard/left front door cables
78 Control panel for electric rear windows on left front door
80 Electric rear windows inhibitor switch
82 Control panel for left electric rear window on left rear door
83 Control panel for right electric rear window on right rear door
84 Left rear electric window motor
85 Right rear electric window motor
86 Connection between rear/left rear door cables
87 Connection between rear/right rear door cables
238 Electric rear windows control unit
244 Integrated services electronic control unit
310 Connecting bridge

**35** Connection between dashboard/left front door cables



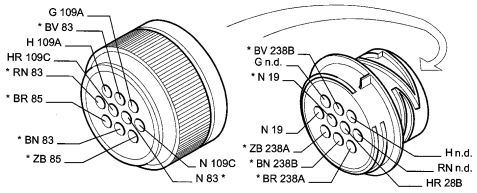

P4F832N03

**86** Connection between rear/left rear door cables




P4F832N03

**87** Connection between rear/right rear door cables




P4F832N04

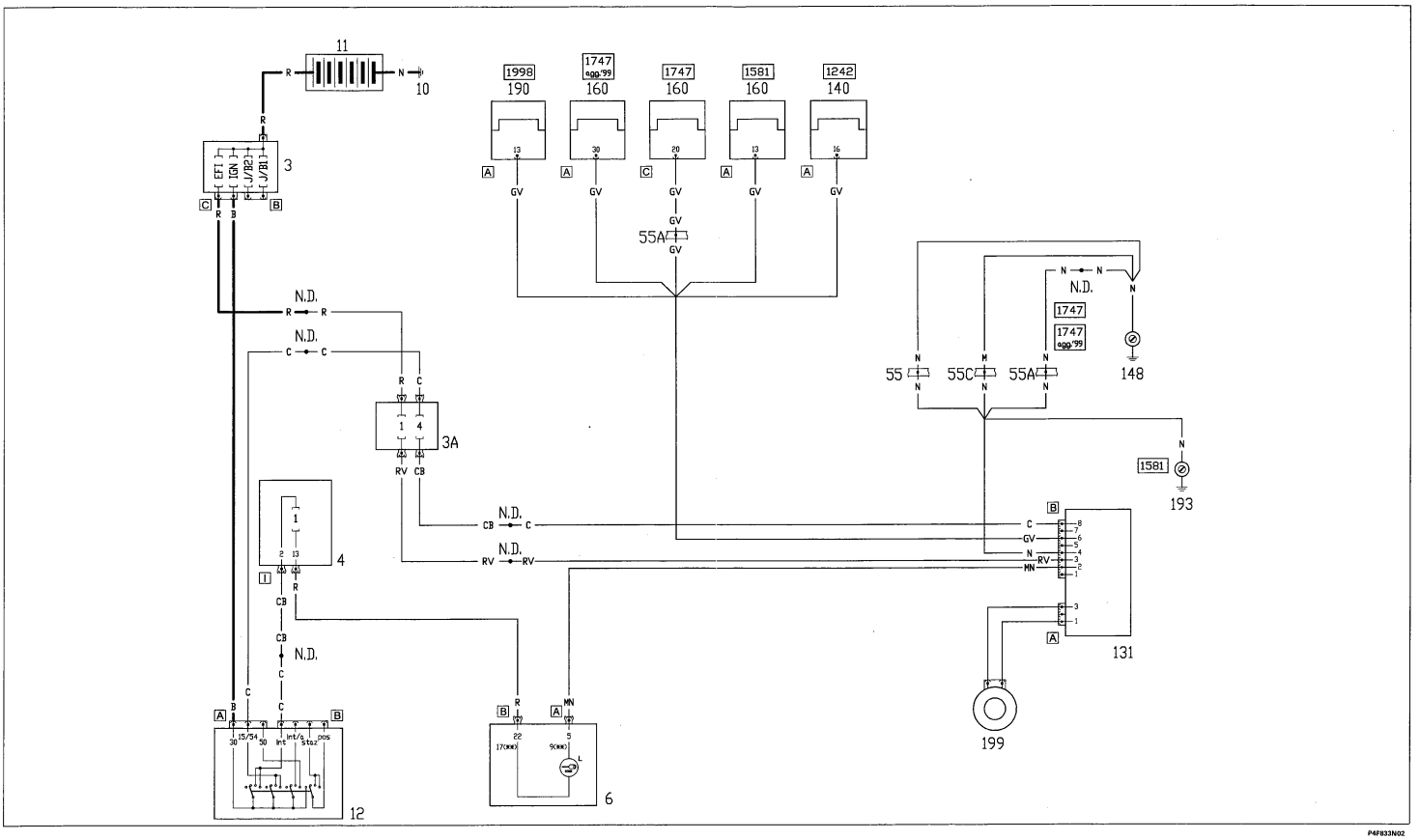
* The cables concerned are marked in the wiring digrams with an asterisk.



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## 55.

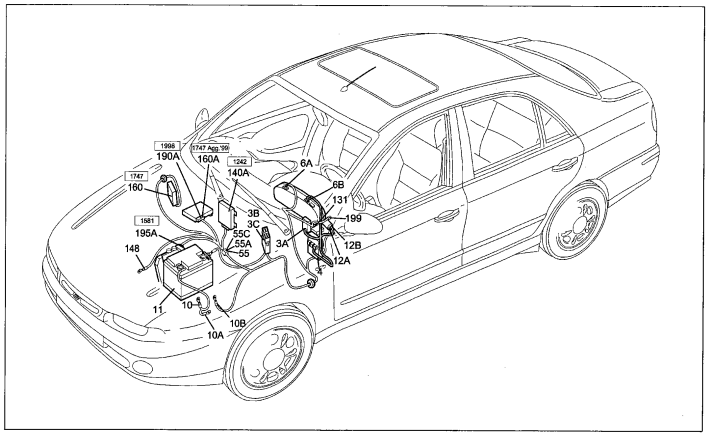
**Fiat -CODE device and failure warning light (petrol engine)**




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P4F834N01

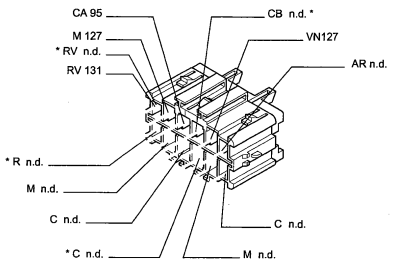
Fiat -**CODE device and failure warning light (petrol engine)**

Component key

3 power fusebox:
4 Junction unit:
6 Instrument panel
10 Engine battery earth
11 Battery
12 Ignition switch
55 Front/engine lead connection
131 Fiat-CODE electronic control unit
140 Injection/ignition control unit (1242)
148 Earth for electronic injection
160 Ignition / injection electronic control unit (1747)
190 Injection/ignition electronic control unit (1998)
195 Ignition / injection control unit. (1581)
199 FIAT CODE aerial

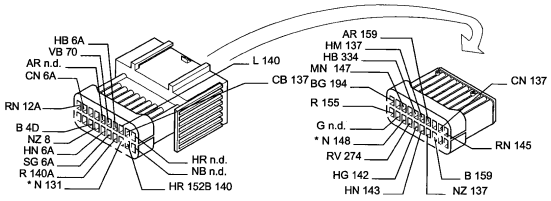
## 55.

### 3A Power fusebox



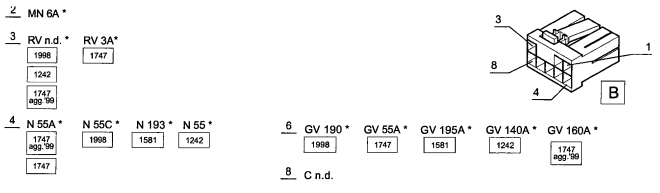

P4F834N02

### 55 Front/engine lead connection




P4F834N03

### 131 Fiat-CODE electronic control unit




P4F834N04

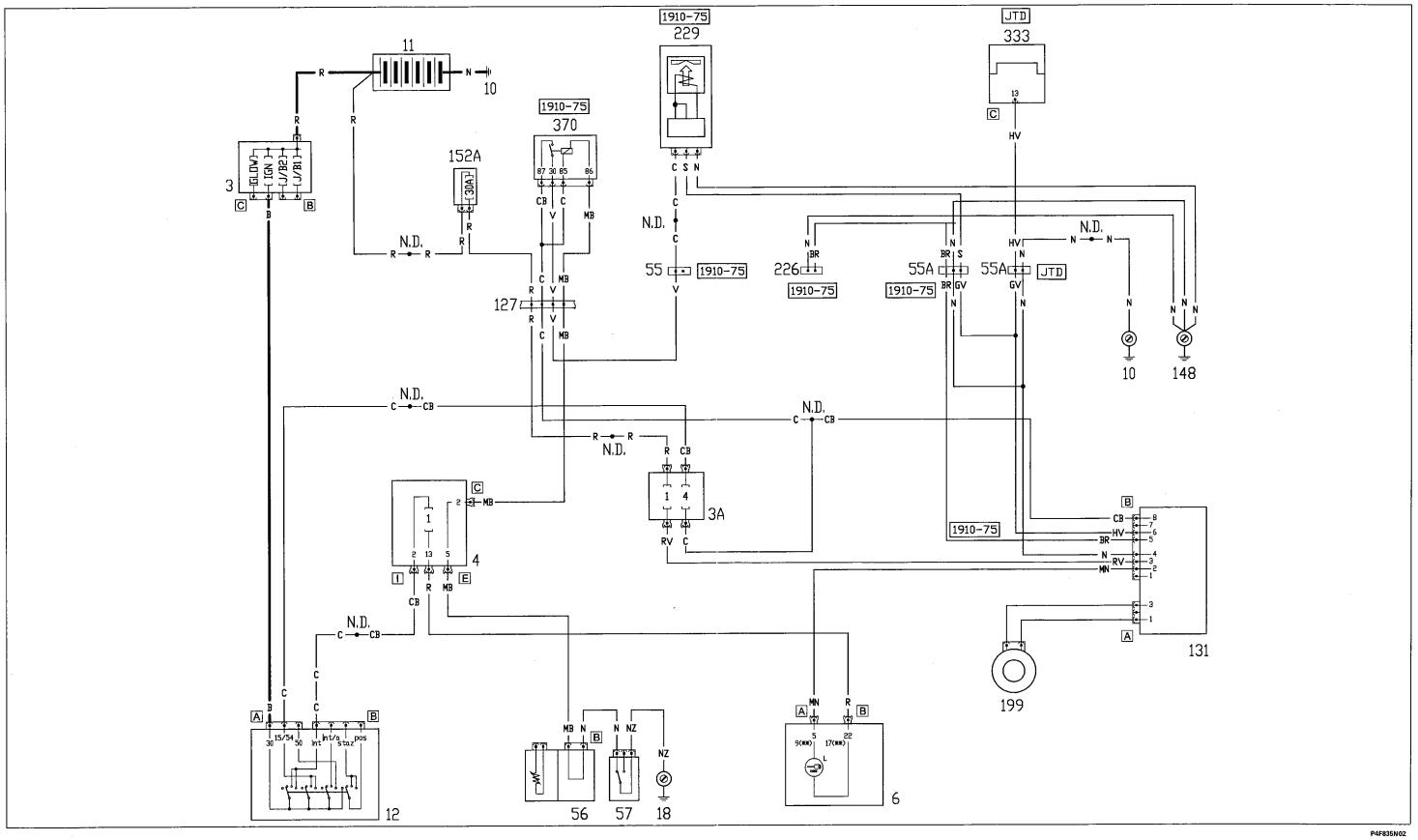
(*) The cables involved in the wiring diagram are marked with an asterisk.



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## 55.

**Fiat -CODE device and failure warning light (Diesel engine)**

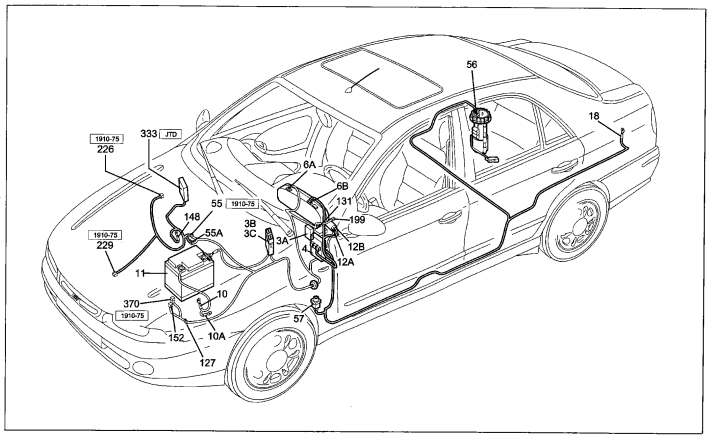



** Variant up to Nov. '99



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## 55.



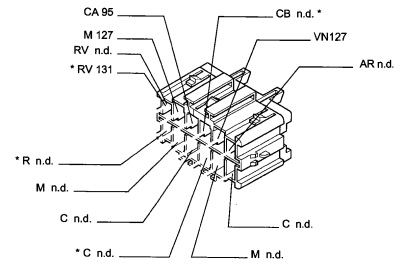

P4F836N01

Fiat -**CODE device and failure warning light (Diesel engine)**

Component key

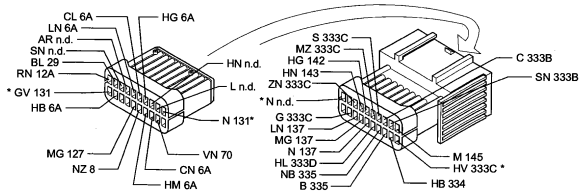
3 power fusebox:
4 Junction unit:
6 Instrument panel
10 Engine battery earth
11 Battery
12 Ignition switch
18 Left rear earth
55 Front/engine lead connection
56 Fuel level gauge control unit
57 Inertia switch
127 Connection between front left cable/cable on relay holder bracket
131 Fiat-CODE electronic control unit
148 Earth for electronic injection
152 Fuse protecting injection system
199 FIAT CODE aerial
226 Tester socket for Fiat CODE system (1910 TD-75)
229 Electric engine stop device (TD)
333 Injection control unit (JTD)
370 Inertia switch relay (1910 TD-75)

**3A** Power fusebox




P4F834N02

**55A** Front/engine lead connection




P4F834N03

**131** Fiat-CODE electronic control unit




P4F834N04

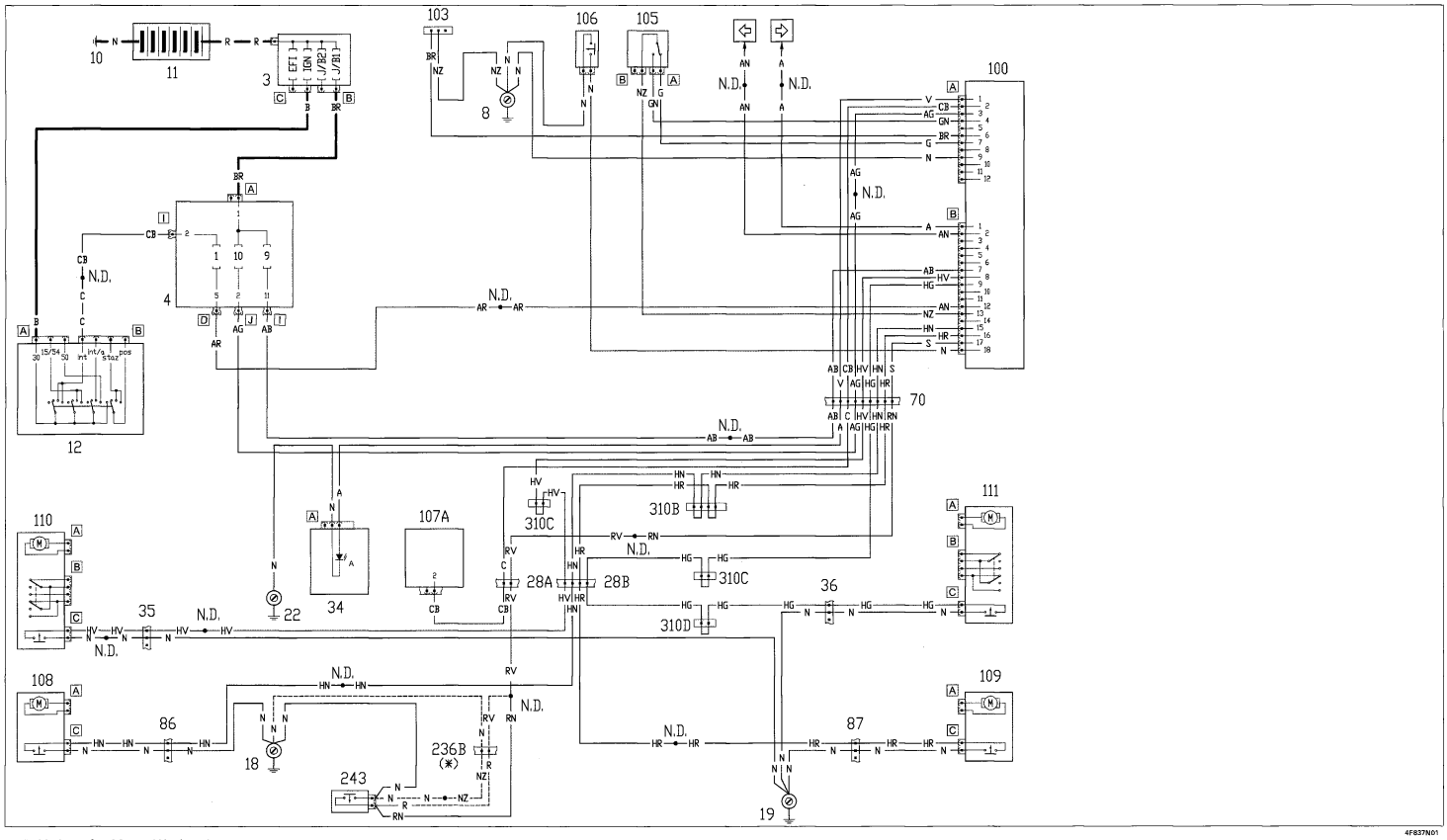
(*) The cables involved in the wiring diagram are marked with an asterisk.



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## 55.

**Alarm**




4F837N01

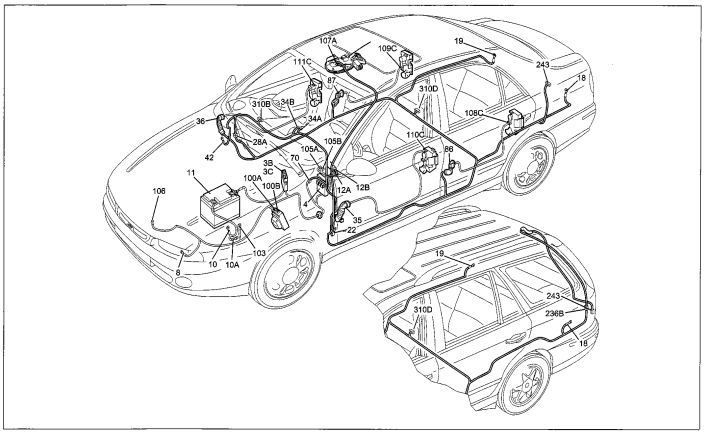
* Variants for Marea Weekend

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## 55.



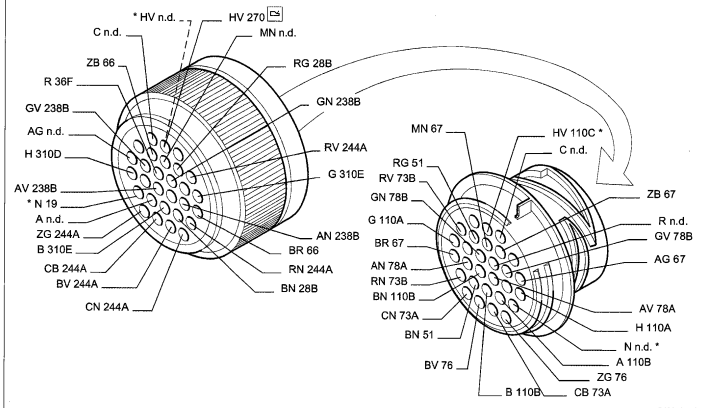

P4F814N01

**Alarm**

**Key to components**

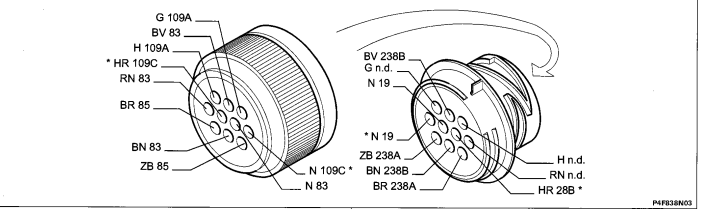
3 Direction indicator
4 Junction unit
8 Left front earth
10 Battery earth on engine
11 Battery
12 Ignition switch
18 Left rear earth
19 Right rear earth
22 Left facia earth
28 Connection between dashboard/rear cables
34 Switch control unit
35 Connection between dashboard/left front door cables
36 Connection between dashboard/front door cables right
42 Right dashboard earth
70 Connection between dashboard/front cables
86 Connection between rear/left rear door cables
87 Connection between rear/right rear door cables
100 Alarm electronic control unit
103 Diagnostic socket for alarm
105 Alarm off switch
106 Alarm switch on bonnet lid
107 Central locking remote control receiver
108 Left rear central locking
109 Right rear central locking
110 Left front central locking
111 Right front central locking
236 Connection between rear cable and tailgate
243 Luggage compartment light button
310 Connecting bridge

**35** Connection between dashboard/left front door cables



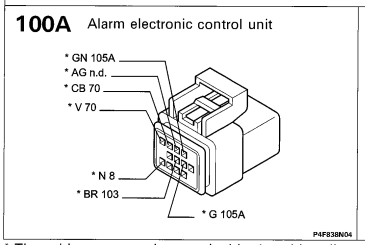

P4F383N03

**87** Connection between rear/right rear door cables



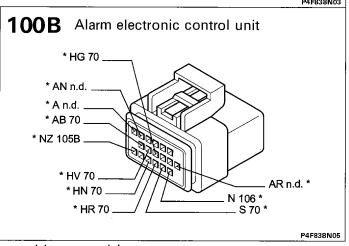

P4F838N03

**100A** Alarm electronic control unit




P4F838N04

**100B** Alarm electronic control unit




P4F838N05

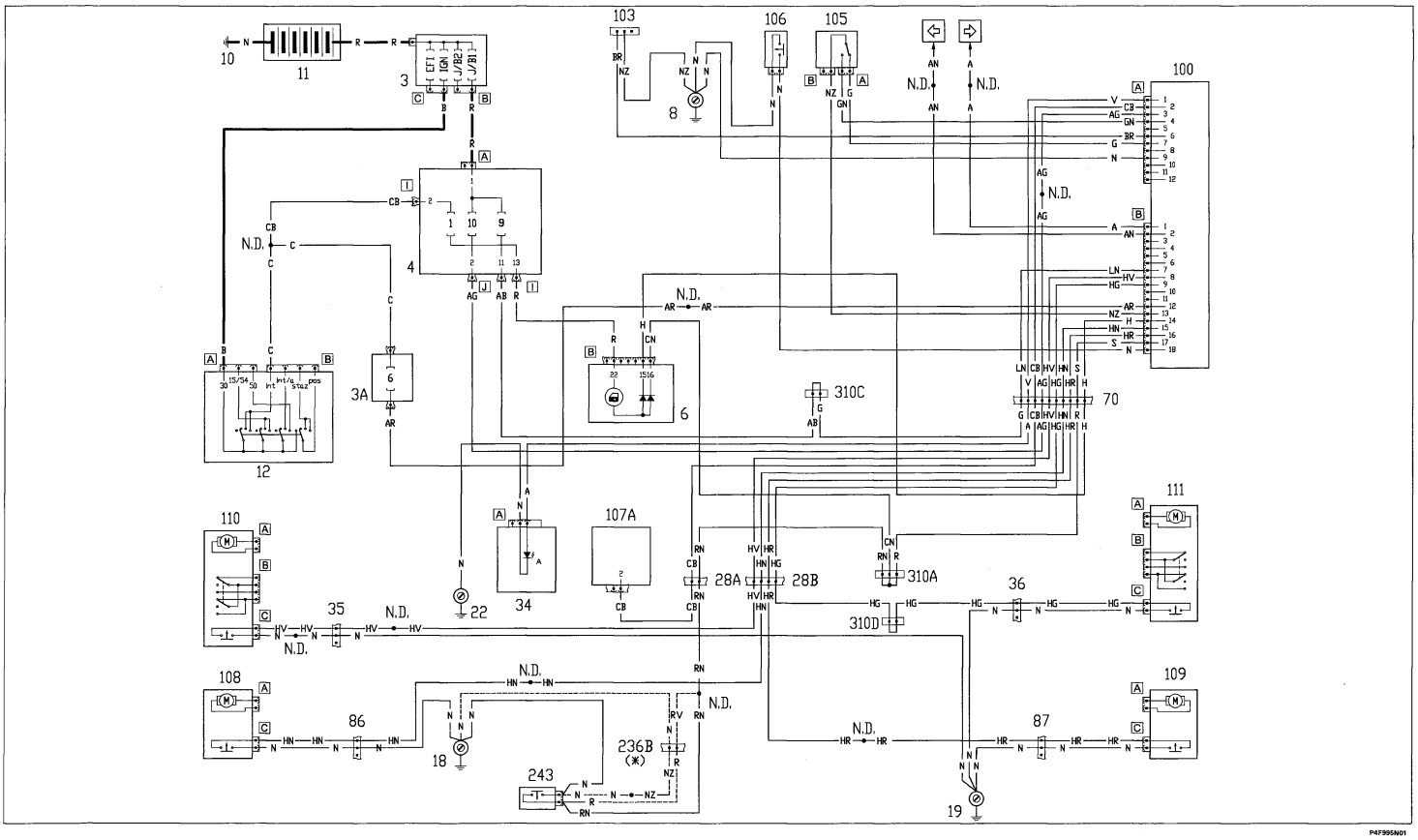
* The cables concerned are marked in the wiring diagram with an asterisk.



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## 55.

**Alarm and Door Check device**



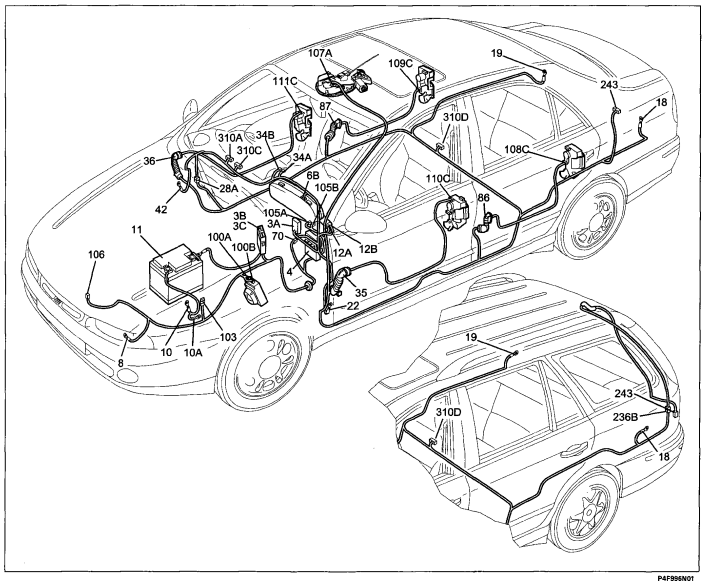

P4F395N01

* Variants for Marea Weekend



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## 55.

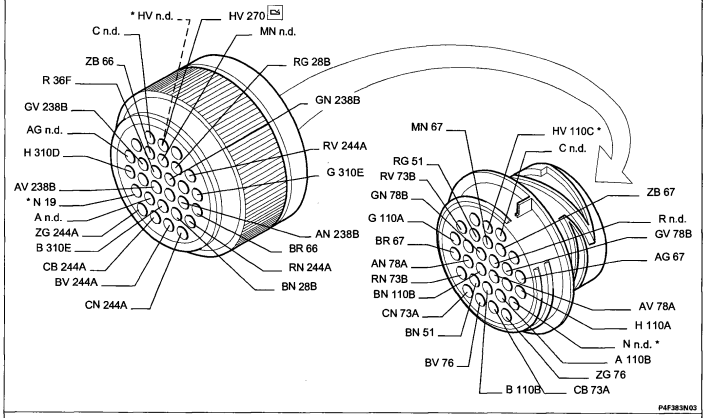



**Alarm and Door Check device**

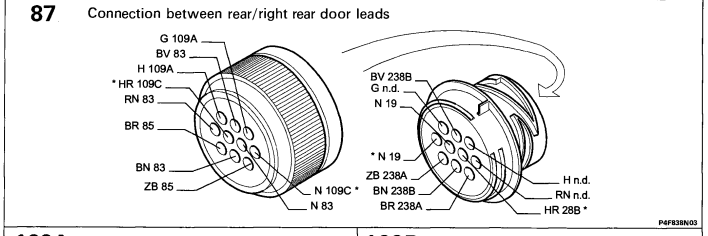
Component key

3 Power fusebox
4 Junction unit
6 Instrument panel
8 Left front earth
10 Engine battery earth
11 Battery
12 Ignition switch
18 Left rear earth
19 Right rear earth
22 Left facia earth
28 Connection between facia/rear cables
34 Switch control unit
35 Connection between dashboard/left front door cables
36 Connection between dashboard/right front door cables
42 Right facia earth
70 Connection between dashborad/front cables
86 Connection between rear/left rear door cables
87 Connection between rear/right rear door cables
100 Alarm electronic control unit
103 Diagnostic socket for alarm system
105 Alarm deactivation switch
106 Alarm device switch on bonnet
107 Door remote control receiver
108 Left rear door lock
109 Right rear door lock
110 Left front door lock
111 Right front door lock
236 Connection between rear cables and tailgate
243 Luggage compartment light button
310 Connection bridge

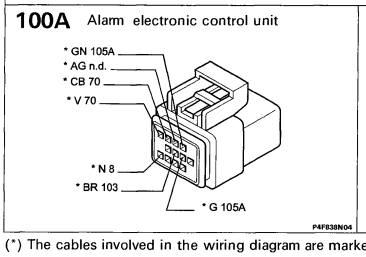
**35** Connection between dashboard/left front door cables



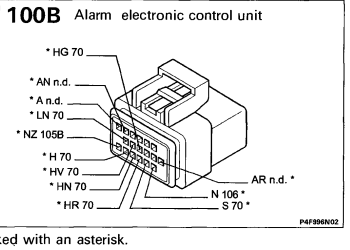

**87** Connection between rear/right rear door leads




**100A** Alarm electronic control unit




**100B** Alarm electronic control unit

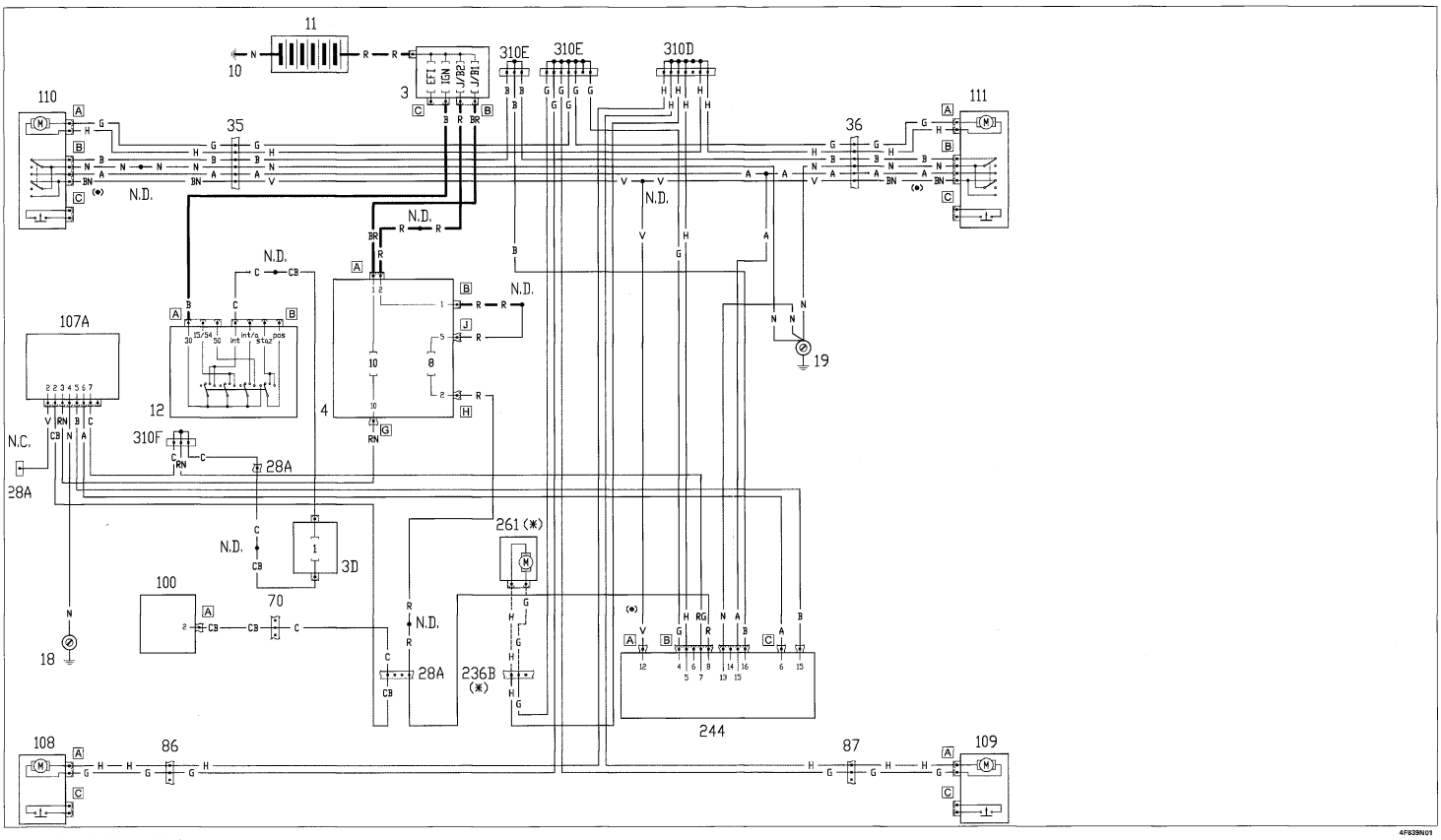



(*) The cables involved in the wiring diagram are marked with an asterisk.



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**Central locking**




4F839N01

* Variants for Marea Weekend

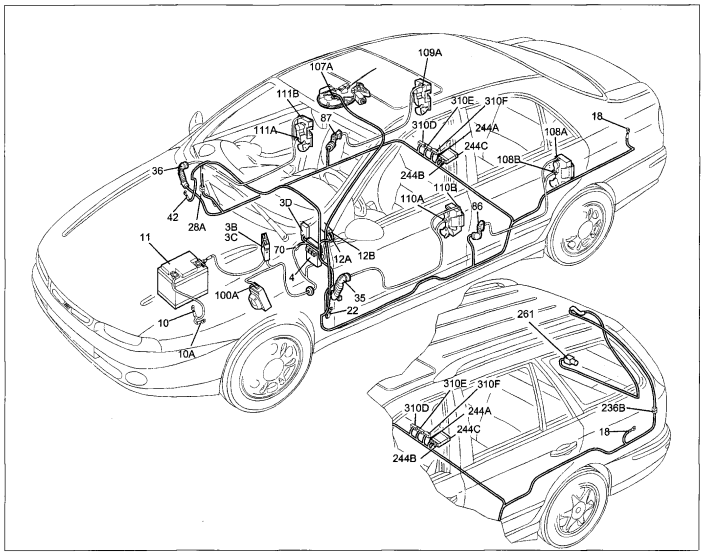
• Only for versions with automatic locking

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## 55.



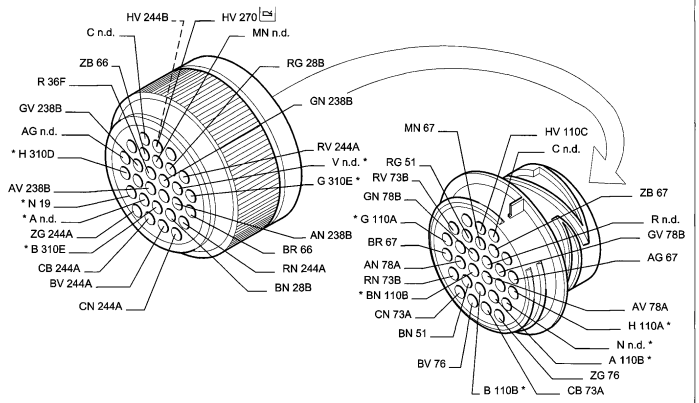

P4F840N01

**Central locking**

Key to components

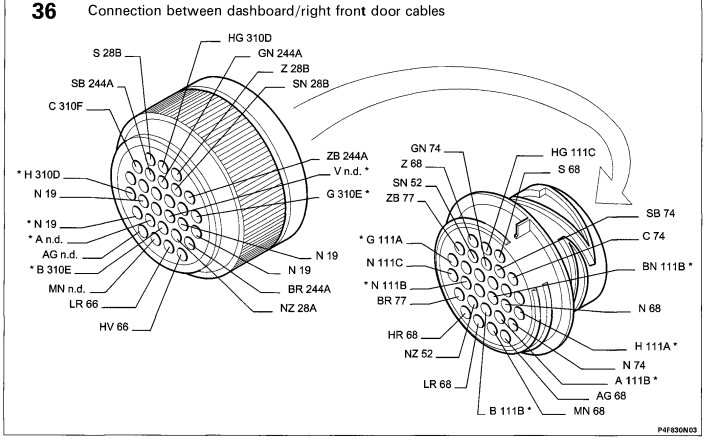
3 Direction indicator
4 Junction unit
10 Battery earth on engine
11 Battery
12 Ignition switch
18 Left rear earth
22 Left facia earth
28 Connection between dashboard/rear cables
35 Connection between dashboard/left front door cables
36 Connection between dashboard/right front door cables
42 Right dashboard earth
70 Connection between dashboard/front cables
86 Connection between rear/left rear door cables
87 Connection between rear/right rear door cables
100 Alarm electronic control unit
107 Central locking remote control receiver
108 Left rear central locking
109 Right rear central locking
110 Left front central locking
111 Right front central locking
236 Connection between rear cable and tailgate
244 Integrated services electronic control unit
261 Tailgate locking/unlocking actuator
310 Connecting bridge

**35** Connection between dashboard/left front door cables




P4F840N02

**36** Connection between dashboard/right front door cables




P4F830N03

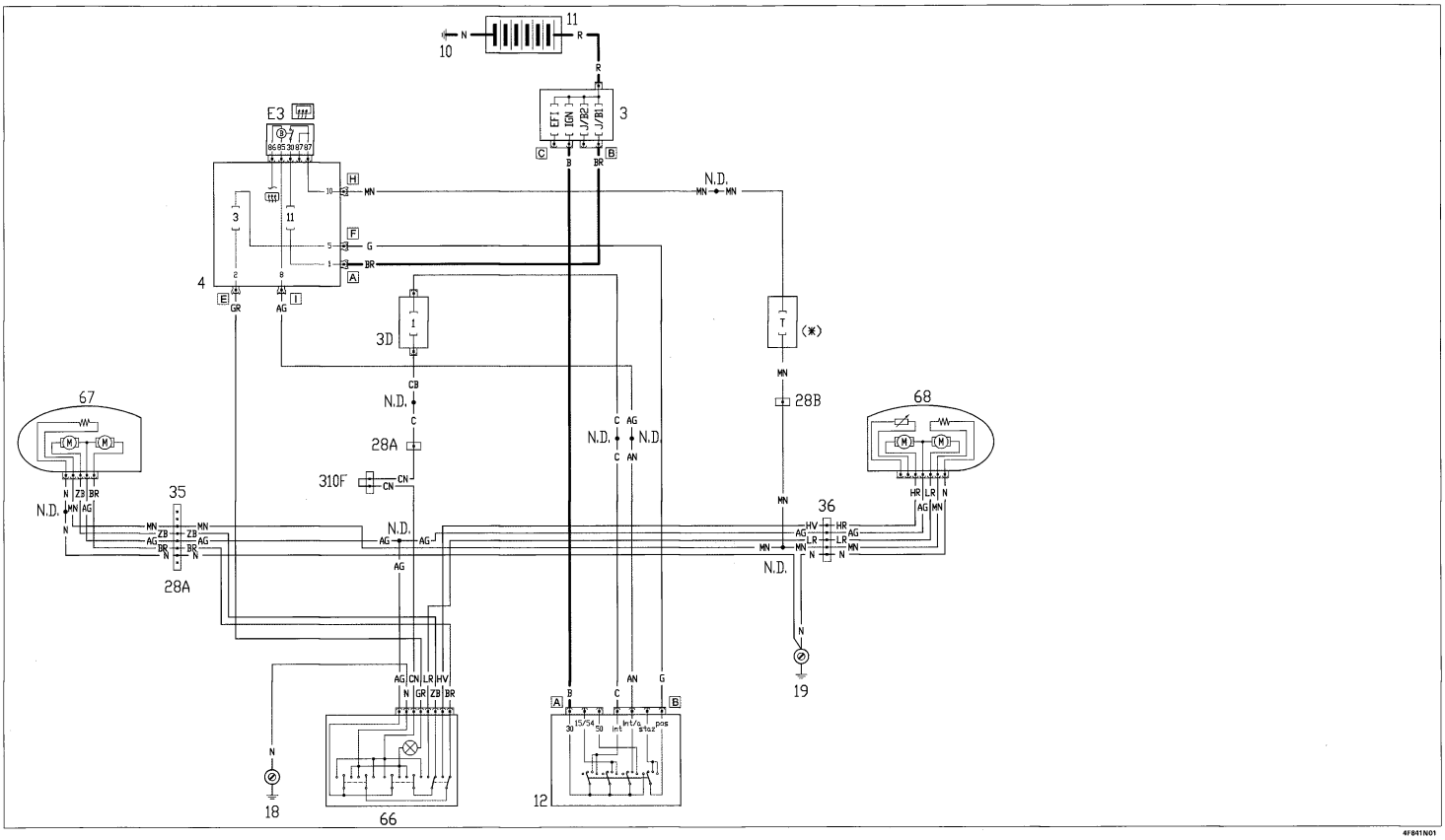
* The cables concerned are marked in the wiring diagram with an asterisk.



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## 55.

**Electrically adjustable, heated external rear view mirrors**



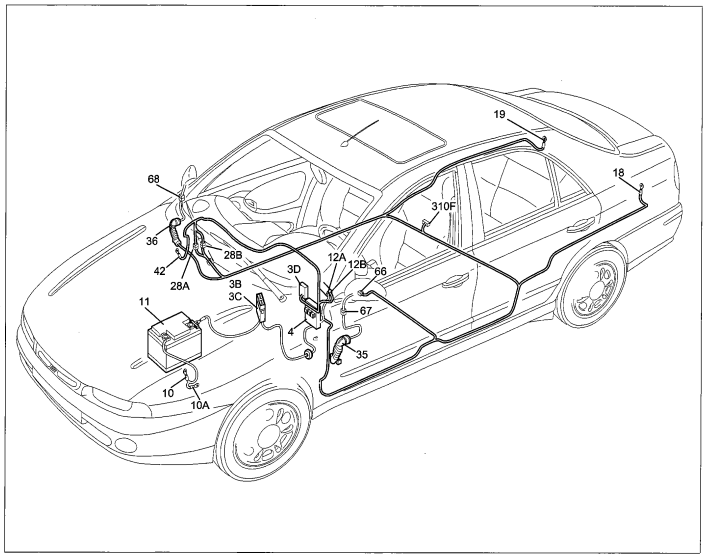

* Safety thermal contact: It opens in the case of overheating and is restored when the cable cools down.

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## 55.



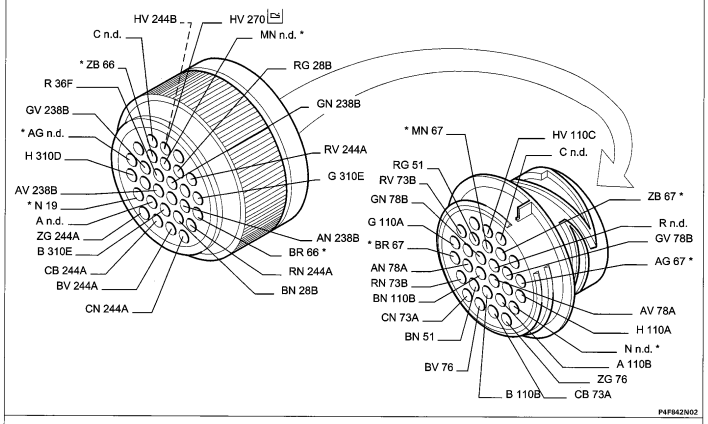

P4F842N01

**Electrically adjustable, heated external rear view mirrors**

Key to components

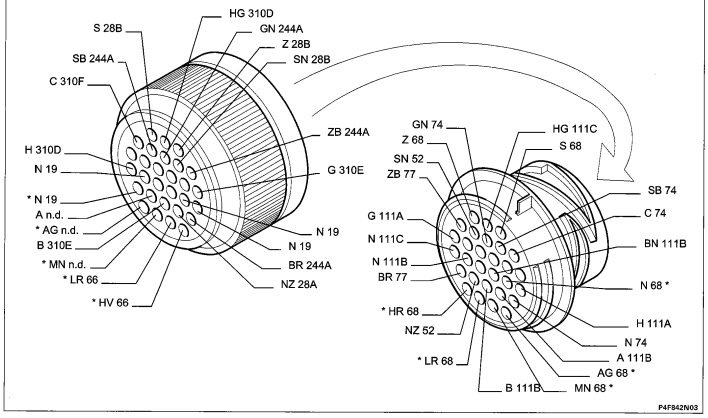
3 Direction indicator
4 Junction unit
10 Battery earth on engine
11 Battery
12 Ignition switch
18 Left rear earth
19 Right rear earth
28 Connection between dashboard/rear cables
35 Connection between dashboard/left front door cables
36 Connection between dashboard/right front door cables
42 Right dashboard earth
66 Electrically-adjustable door mirror control buttons
67 Left external rear view mirror
68 Right external rear view mirror
310 Connecting bridge

**35** Connection between dashboard/left front door cables




P4F842N02

**36** Connection between dashboard/right front door cables




P4F842N03

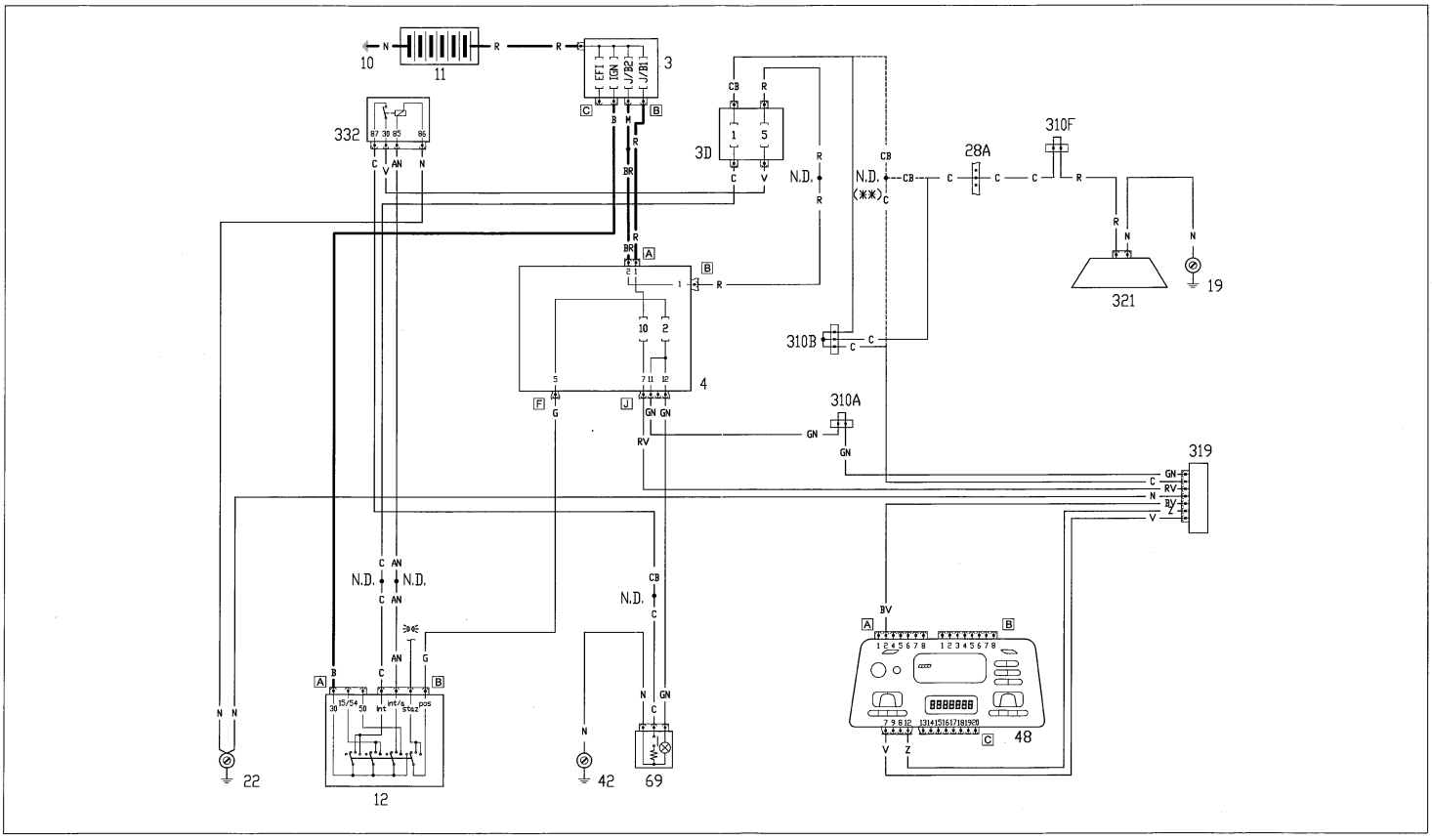
* The cables concerned are marked in the wiring diagram with a circle.



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## 55.

**Predisposition for car phone and TELEPASS**



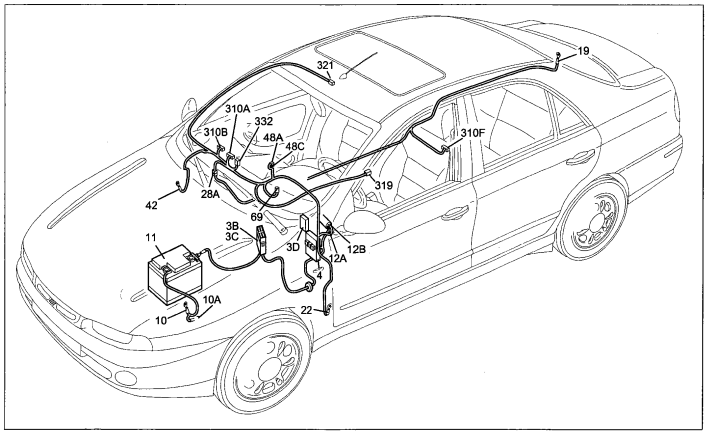

P4F843N02

** Variants up to Nov. '99



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## 55.



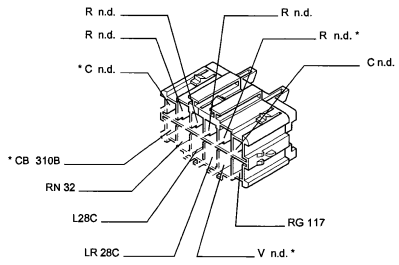

P4F844N06

**Predisposition for car phone and TELEPASS**

Component key

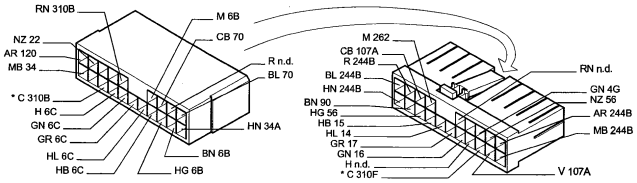
3 power fusebox:
4 Junction unit:
10 Engine battery earth
11 Battery
12 Ignition switch
19 Right rear earth
22 Left facia earth
28 Connection between facia/rear cables
42 Right facia earth
48 Radio receiver with clock
69 Cigar lighter
310 Connection bridge
319 Connection for car phone
321 Connection for TELEPASS
332 Ignition activated power relay.

**3D** Power fusebox



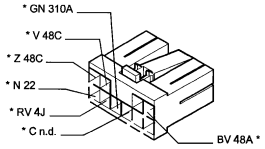

P4F844N07

**28A** Facia/rear lead connection



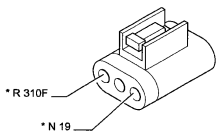

P4F844N08

**319** Connection for car phone




P4F844N09

**321** Connection for TELEPASS




P4F844N05

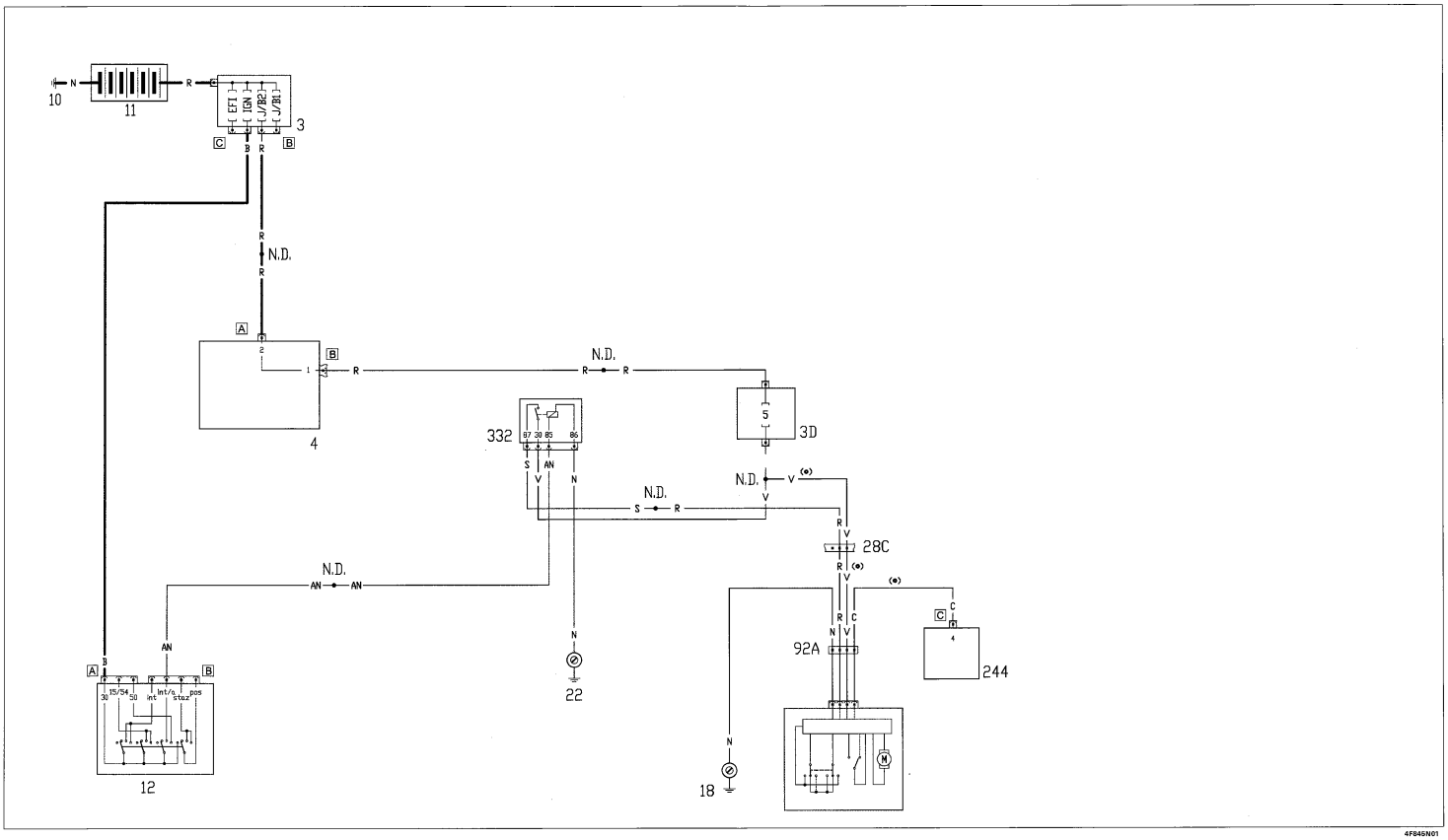
(*) The cables involved in the wiring diagram are marked with an asterisk.



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## 55.

**Electrically operated sun roof**



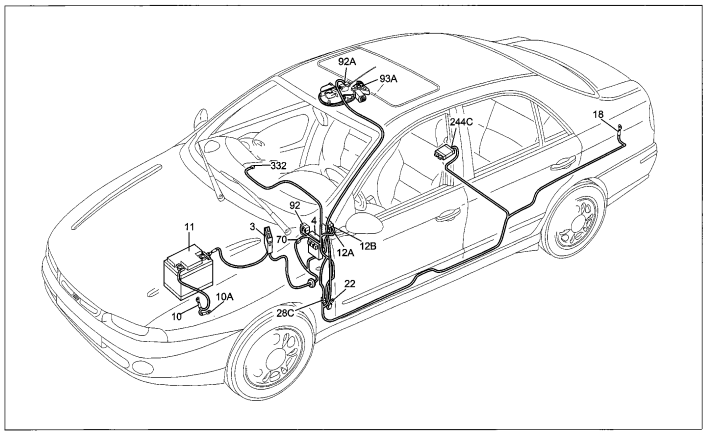

(•) Automatic window locking

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## 55.



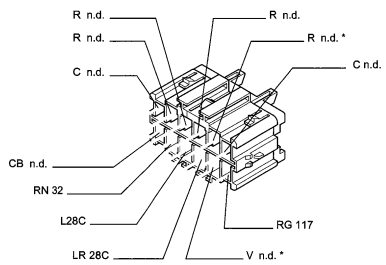

P4F846N01

**Electrically operated sun roof**

Key to components

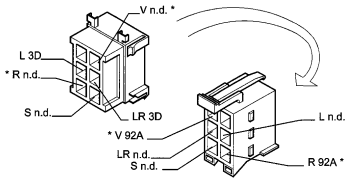
| | |
|---|---|
| 3 | Direction indicator |
| 4 | Junction unit |
| 10 | Battery earth on engine |
| 11 | Battery |
| 12 | Ignition switch |
| 18 | Left rear earth |
| 22 | Left facia earth |
| 28 | Connection between dashboard/rear cables |
| 70 | Connection between dashboard/front cables |
| 92 | Connection for electrically operated sun roof cables |
| 93 | Electrically operated sun roof control unit |
| 244 | Integrated services electronic control unit |
| 332 | Power relay controlled by ignition |

**3D** Power fuse box



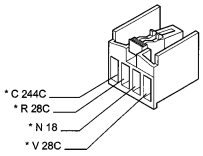

P4F846N03

**28C** Connection between dashboard/rear cables



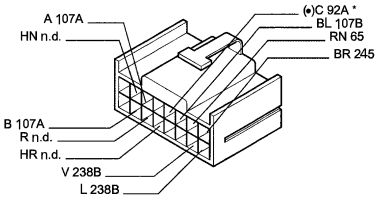

P4F846N03

**92A** Connection for electrically operated sun roof cables




P4F846N04

**244C** Integrated services electronic control unit




P4F846N05

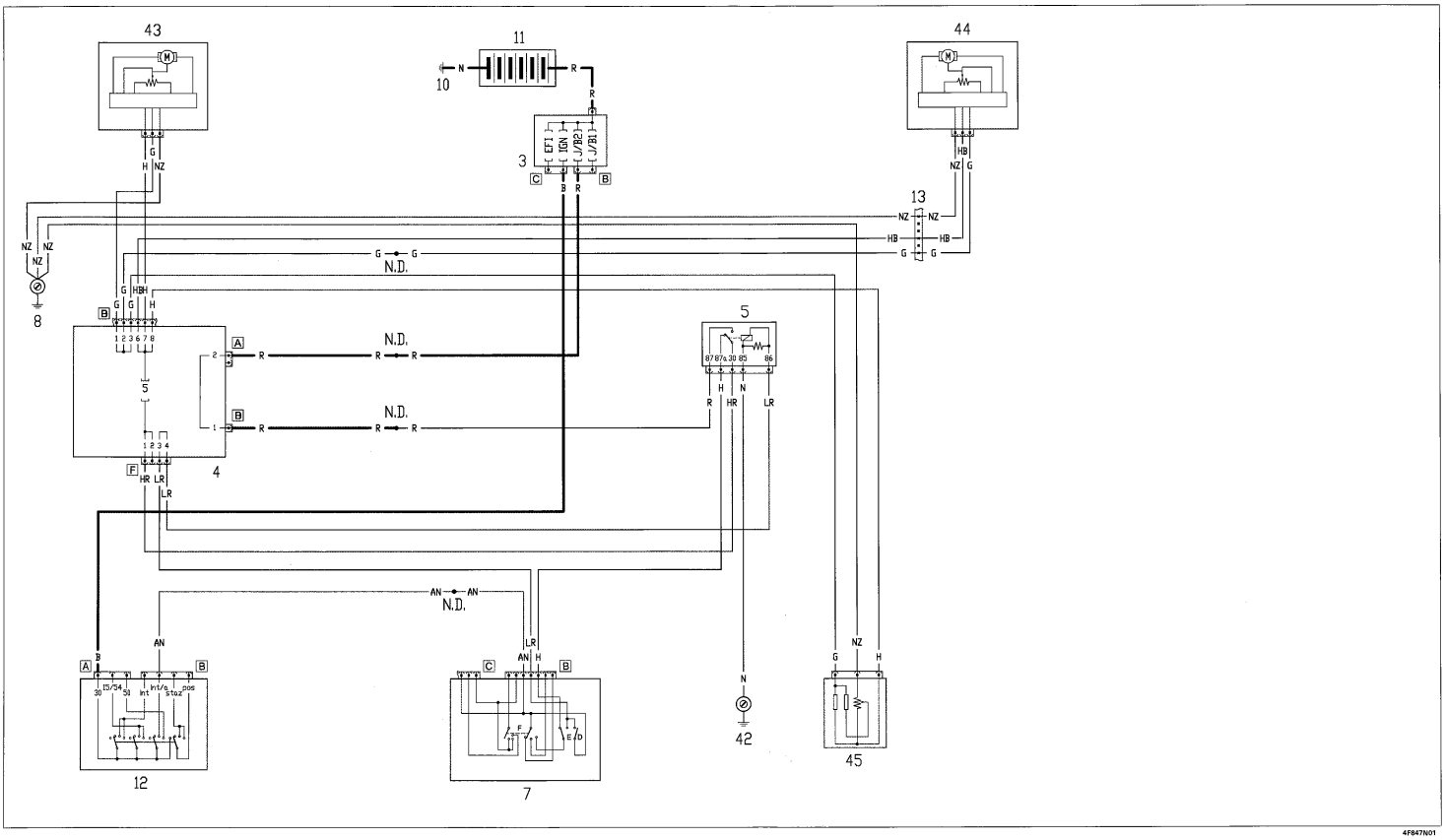
* The cables concerned are marked in the wiring diagram with an asterisk.



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## 55.

**Headlamp alignment**

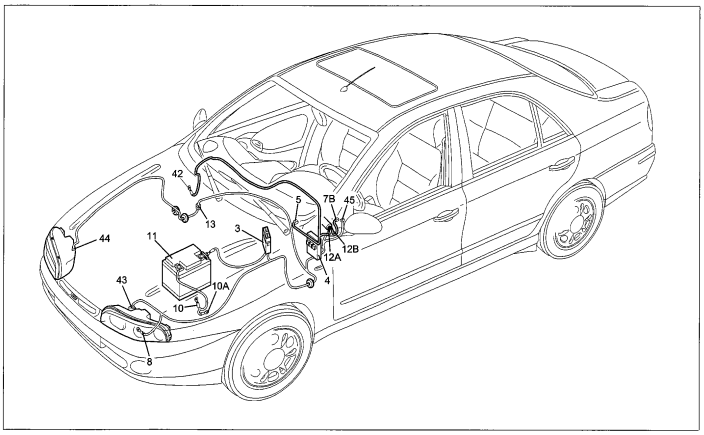



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## 55.



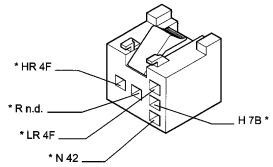

P4F848N01

**Headlamp alignment**

Key to components

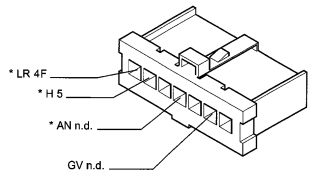
3 Direction indicator
4 Junction unit
5 Dipped headlamps relay feed
7 Stalk unit
8 Left front earth
10 Battery earth on engine
11 Battery
12 Ignition switch
13 Connection between right/left front cables
42 Right dashboard earth
43 Electrical actuator for left headlamp alignment
44 Electrical actuator for right headlamp alignment
45 Headlamp alignment control unit

**5** Dipped headlamps relay feed



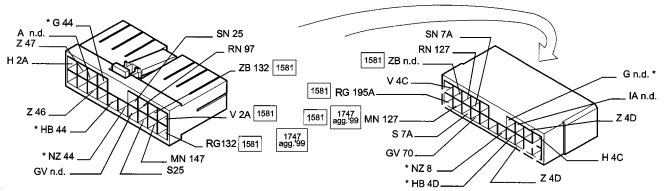

P4F848N02

**7B** Stalk unit



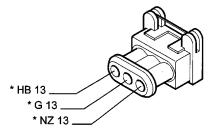

P4F848N03

**13** Connection between right/left front cables



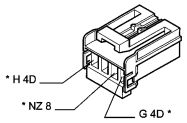

P4F848N04

**44** Electrical actuator for right headlamp alignment




P4F848N05

**45** Headlamp alignment control unit




P4F848N06

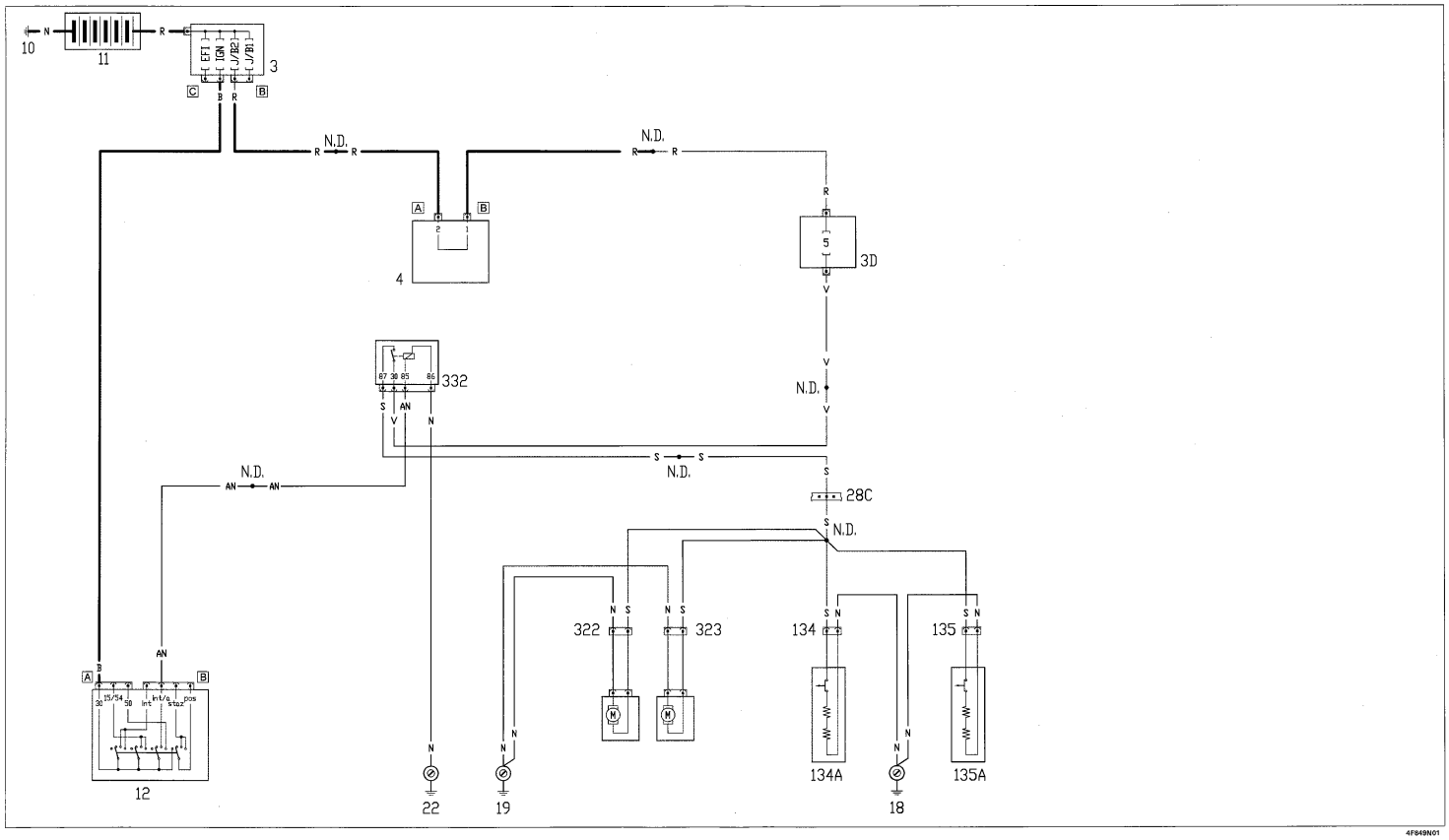
* The cables concerned are marked in the wiring diagram with an asterisk.



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## 55.

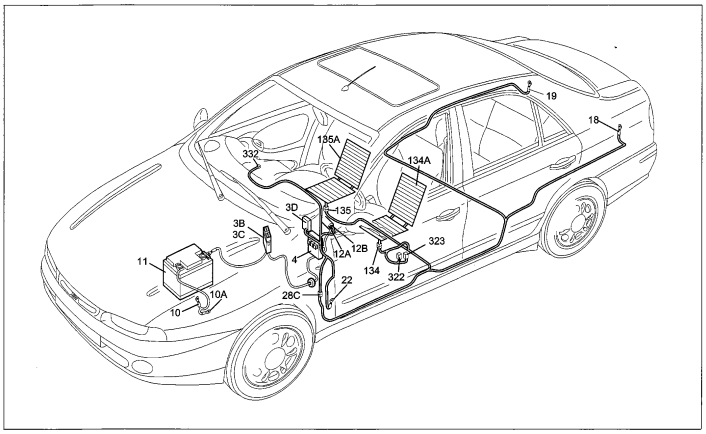
**Adjustable, heated front seats**






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## 55.



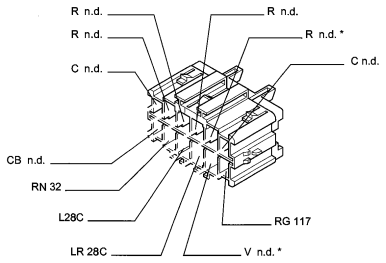

P4F850N01

**Adjustable, heated front seats**

**Key to components**

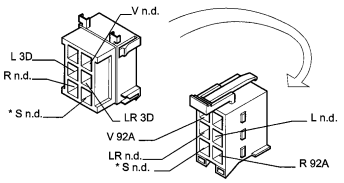
3 Direction indicator
4 Junction unit
10 Battery earth on engine
11 Battery
12 Ignition switch
18 Left rear earth
19 Right rear earth
22 Left facia earth
28 Connection between dashboard/rear cables
134 Connection between rear/driver's heated seat cables
135 Connection between rear/passenger heated seat cables
322 Connection for seat height adjustment
323 Connection for seat lumbar adjustment
332 Power relay controlled by ignition

**3D** Power fuse box



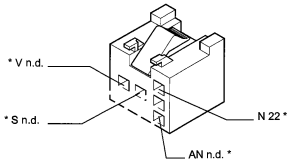

P4F850N02

**28C** Connection between dashboard/rear cables




P4F850N03

**332** Power relay controlled by ignition




P4F850N04

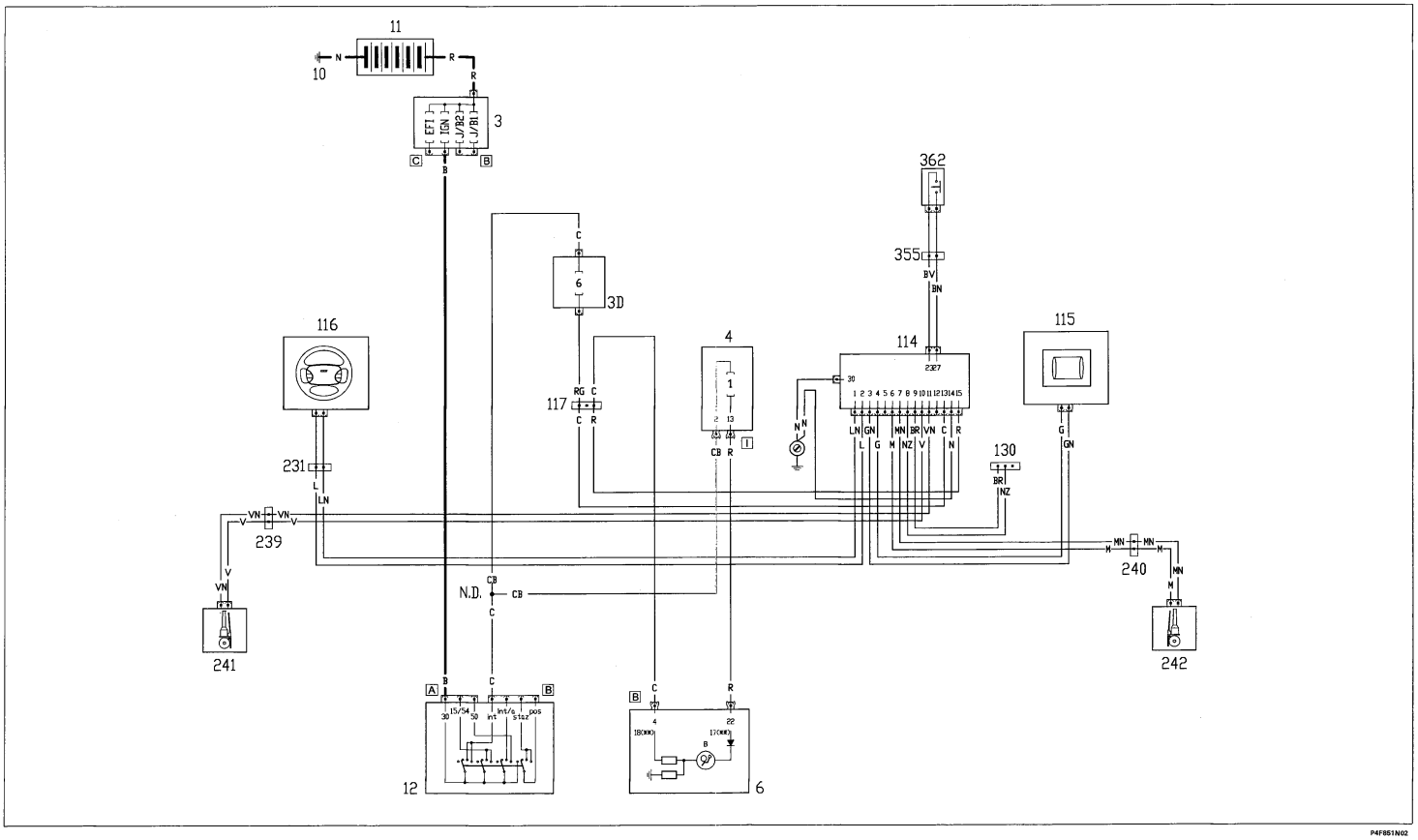
* The cables concerned are marked in the wiring diagram with an asterisk.



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## 55.

**Air Bag, pretensioners and failure warning light**



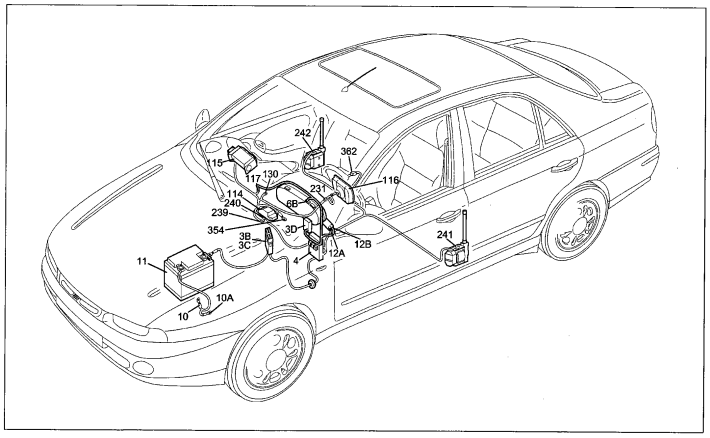

P4F851N02

** Variant up to Nov. '99



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## 55.



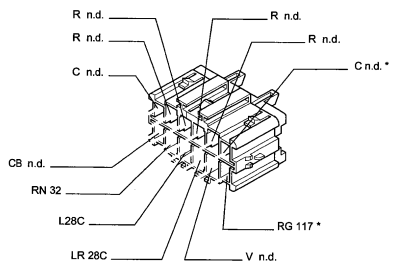

P4F852N01

**Air Bag, pretensioners and failure warning light**

**Component key**

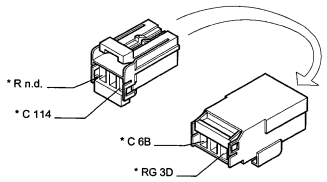
3 power fusebox:
4 Junction unit:
6 Instrument panel
10 Engine battery earth
11 Battery
114 Air bag electronic contol unit
115 Passenger's Air Bag
116 Driver's Air Bag
117 Airbag/facia lead connections
130 Tester socket for Air Bag
231 Clock spring connector
239 Air Bag/left pretensioner cables connection
240 Air Bag/right pretensioner cables connection
241 Left pretensioner
242 Right pretensioner
354 Air Bag earth
362 Passenger presence sensor

**3D** Power fusebox



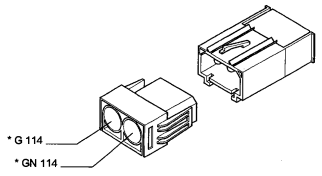

P4F852N03

**117** Air Bag/facia cables connection



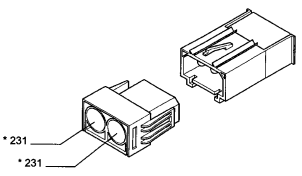

P4F852N03

**115** Passenger Air Bag




P4F852N04

**116** Driver's Air Bag




P4F852N05

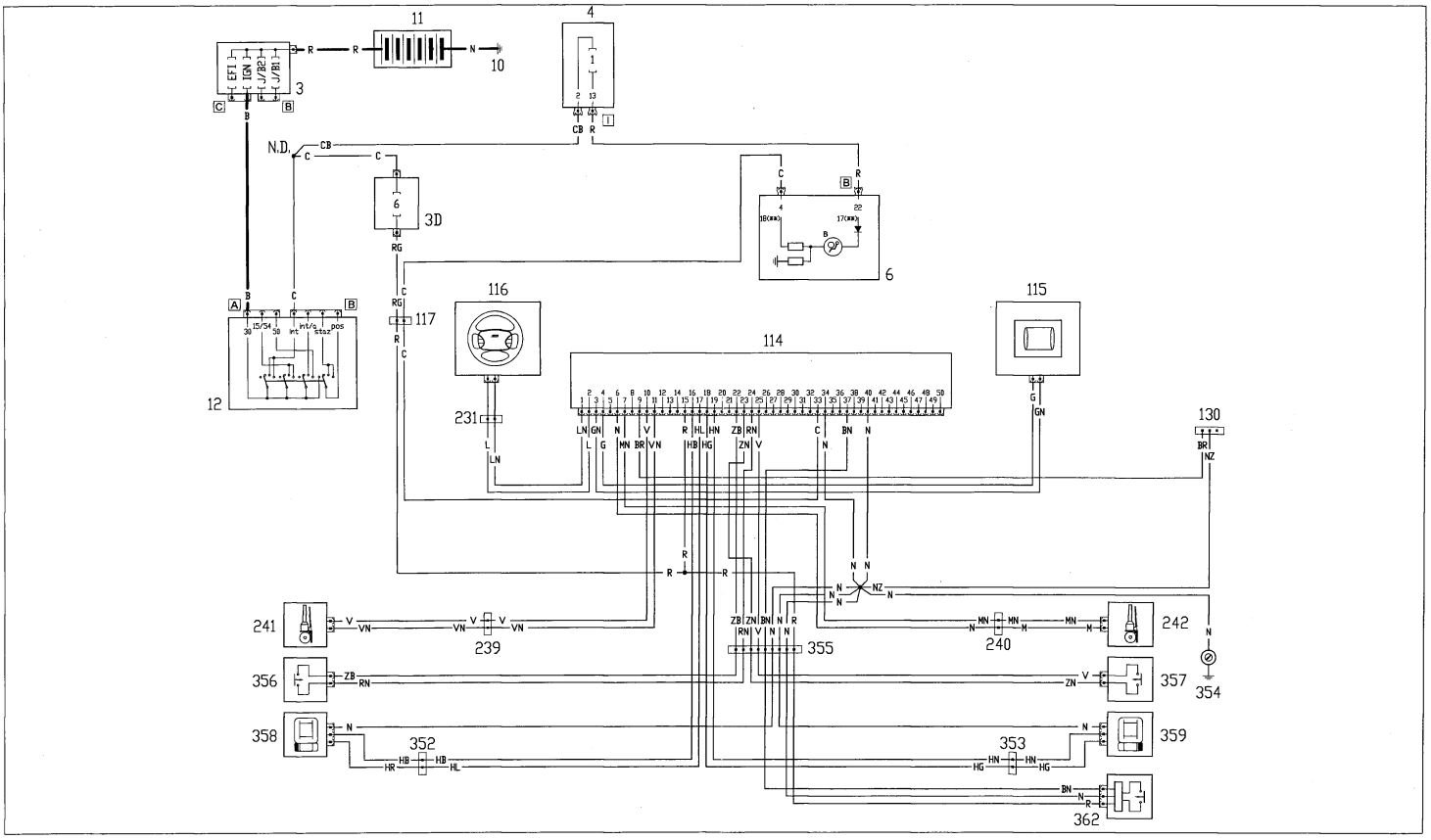
(*) The cables involved in the wiring diagram are marked with an asterisk.



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## 55.

**Air Bag with Side Bag and pretensioners and failure warning light**

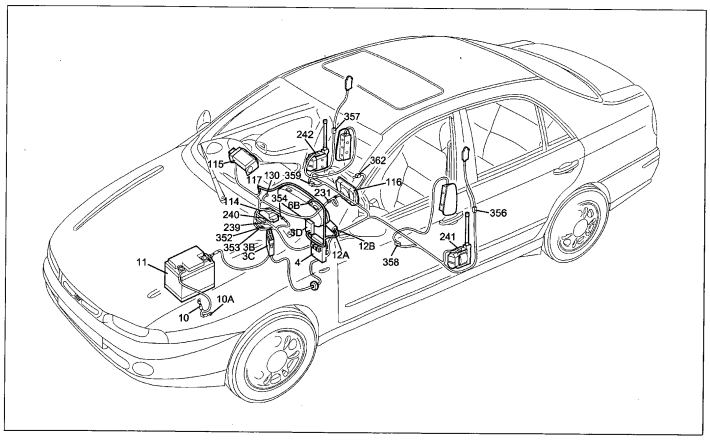



** Variant up to Nov. '99



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## 55.



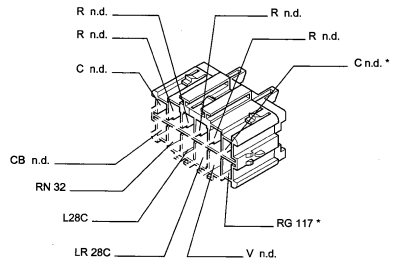

P4F854N01

**Air Bag with Side Bag and pretensioners and failure warning light**

Component key

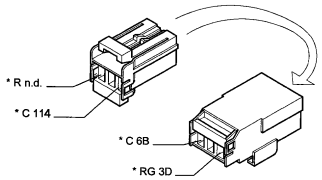
3 power fusebox:
4 Junction unit:
6 Instrument panel
10 Engine battery earth
11 Battery
12 Ignition switch
114 Air bag electronic contol unit
115 Passenger's Air Bag
116 Driver's Air Bag
117 Airbag/facia lead connections
130 Tester socket for Air Bag
231 Clock spring connector
239 Air Bag/left pretensioner cables connection
240 Air Bag/right pretensioner cables connection
241 Left pretensioner
242 Right pretensioner
352 Left side bag connection
353 Right side bag connection
354 Air Bag earth
356 Left side bag sensor
357 Right side bag sensor
358 Left side bag
359 Right side bag
362 Passenger presence sensor

**3D** Power fusebox



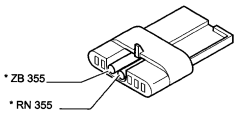

P4F854N03

**117** Air Bag/facia cables connection



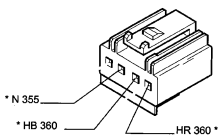

P4F854N03

**356** Left side bag sensor




P4F854N04

**358** Left side bag




P4F854N05

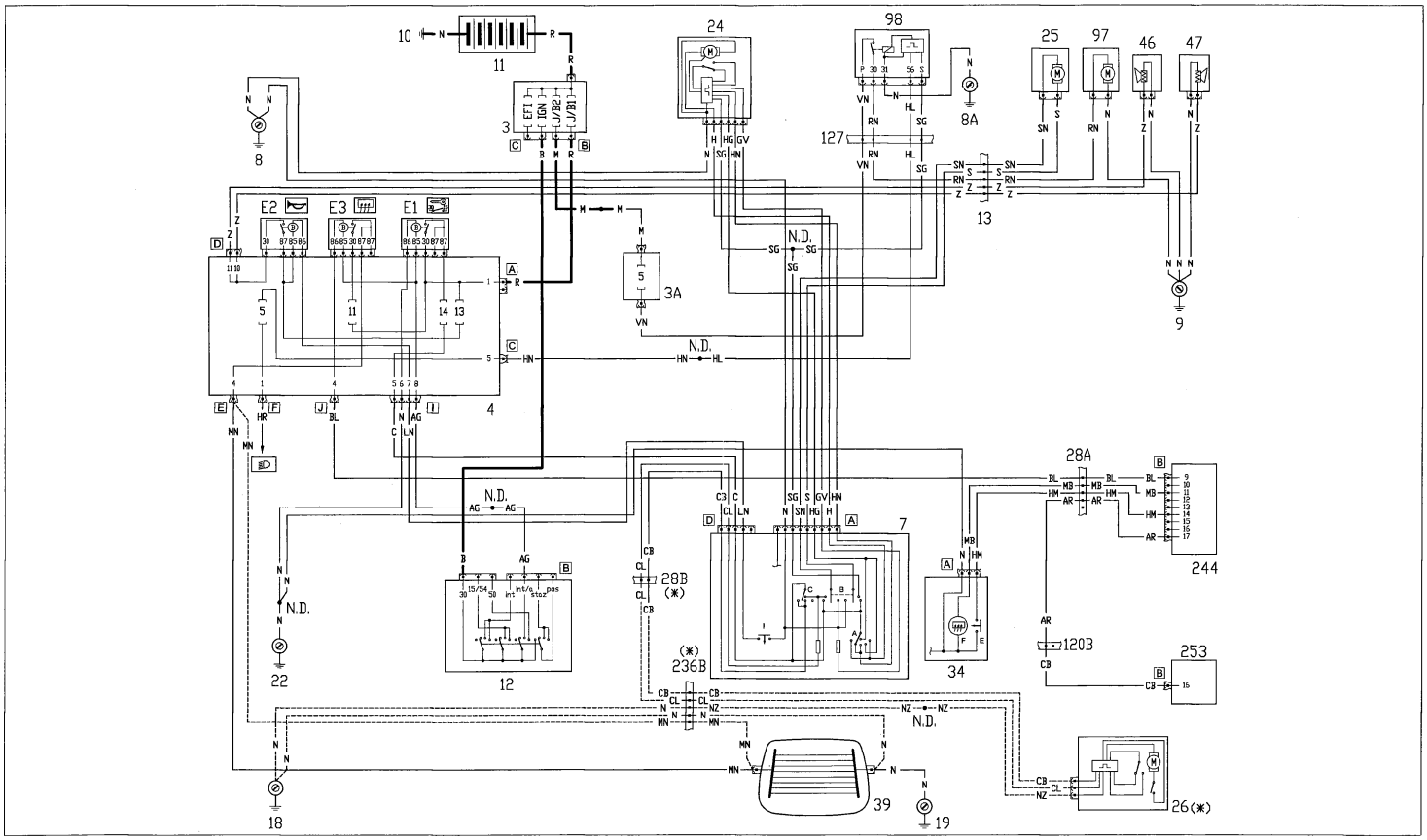
(*) The cables involved in the wiring diagram are marked with an asterisk.



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# 55.

**Windscreen wash/wipe - Rear wash/wipe - Horns - Heated rear window - Headlamp washers**



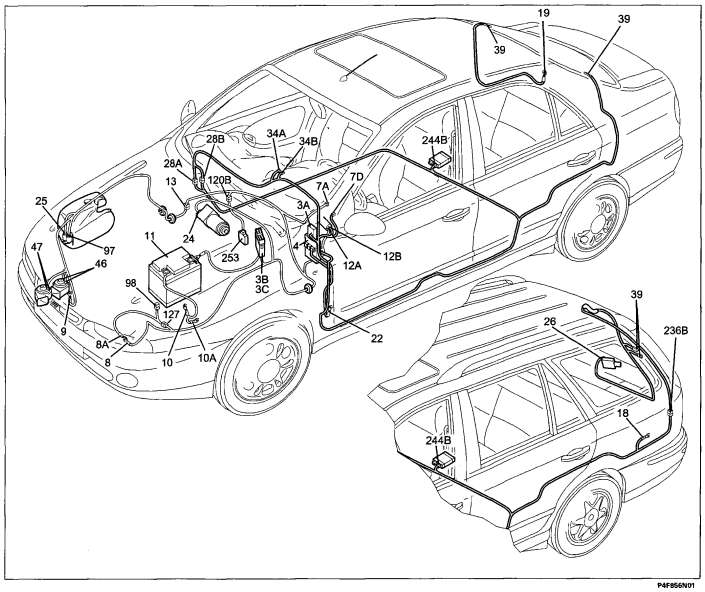

P4F855N02

* Variants for Marea Weekend



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## 55.

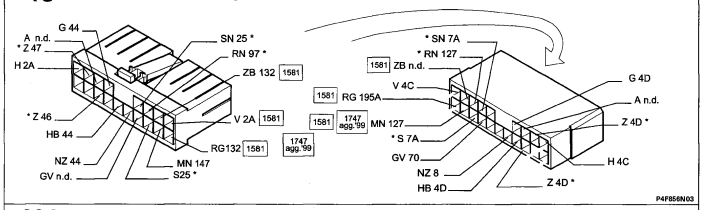



**Windscreen wash/wipe - Rear wash/wipe - Horn - Heated rear window - Headlamp washers**

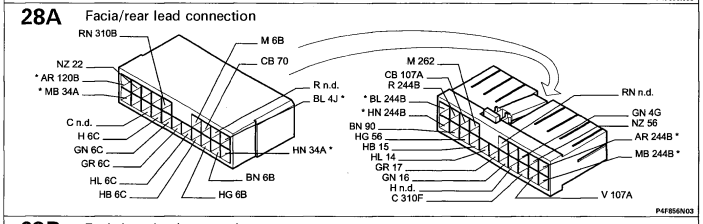
Component key

3 power fusebox:
4 Junction unit:
7 Stalk unit
8 Left front earth
9 Right front earth
10 Engine battery earth
11 Battery
12 Ignition switch
13 Connection between right/left front cables
18 Left rear earth
19 Right rear earth
22 Left facia earth
24 Windscreen wiper motor
25 Front/rear washer pump
26 Rear wiper motor
28 Connection between facia/rear cables
34 Switch control unit
39 Heated rear window
46 Left low tone horn
47 Right high tone horn
97 Headlamp washer pump
98 Headlamp washer intermittence
120 Connection for air conditioning unit cables
127 Connection between front left cable/cable on relay holder bracket
236 Connection between rear cables and tail-gate
244 Integrated services control system
253 Air conditioner control unit

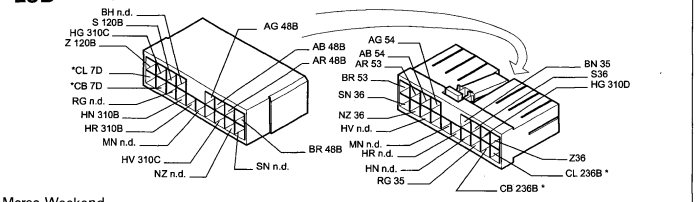
**13** Connection between right/left front cables




**28A** Facia/rear lead connection

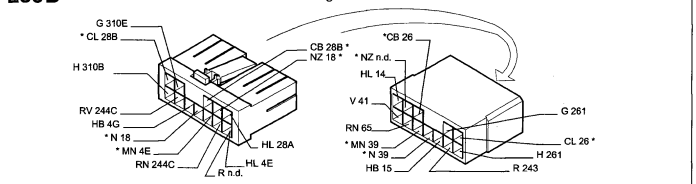



**28B** Facia/rear lead connection




Marea Weekend

**236B** Connection betwen rear lead and tail-gate




Marea Weekend

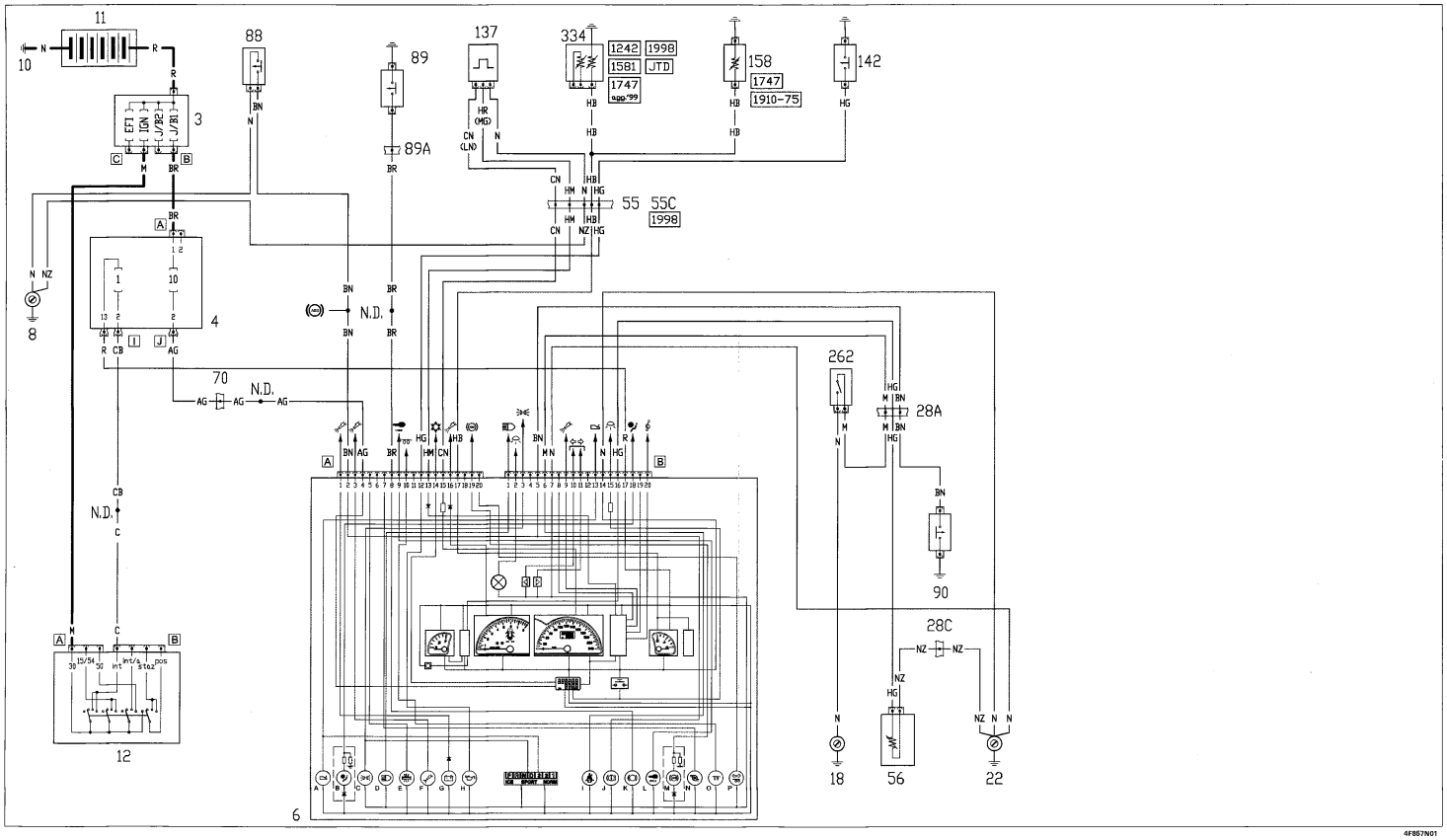
(*) The cables involved in the wiring diagram are marked with an asterisk.



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## 55.

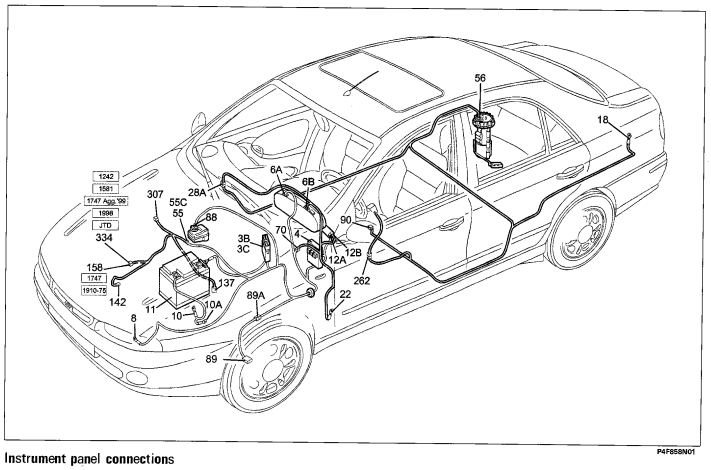
**Instrument panel connections**






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## 55.

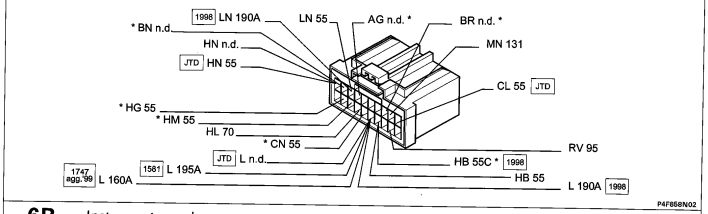



**Instrument panel connections**

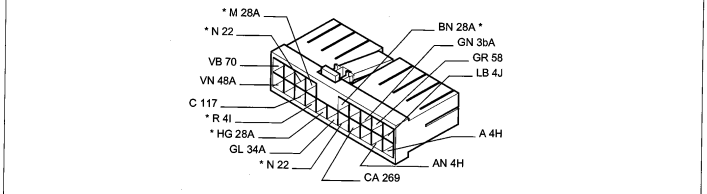
**Key to components**

3 Direction indicator
4 Junction unit
6 Instrument panel
8 Left front earth
10 Battery earth on engine
11 Battery
12 Ignition switch
18 Left rear earth
22 Left facia earth
28 Connection between dashboard/rear cables
55 Connection between front/engine cables
56 Fuel gauge unit
70 Connection between dashboard/front cables
88 Insufficient brake fluid level sensor
89 Left brake pad wear sensor
90 Switch signalling handbrake applied
137 Vehicle speed sensor
142 Switch signalling insufficient engine oil pressure
158 Water temperature sensor for instrument
262 Seat belt warning light switch
334 Engine temperature twin sender unit

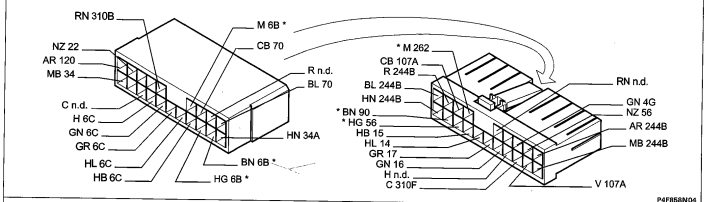
### 6A Instrument panel



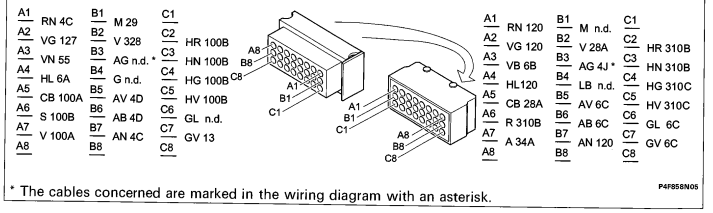

### 6B Instrument panel




### 28A Connection between dashboard/rear cables




### 70 Connection between dashborad/front cables



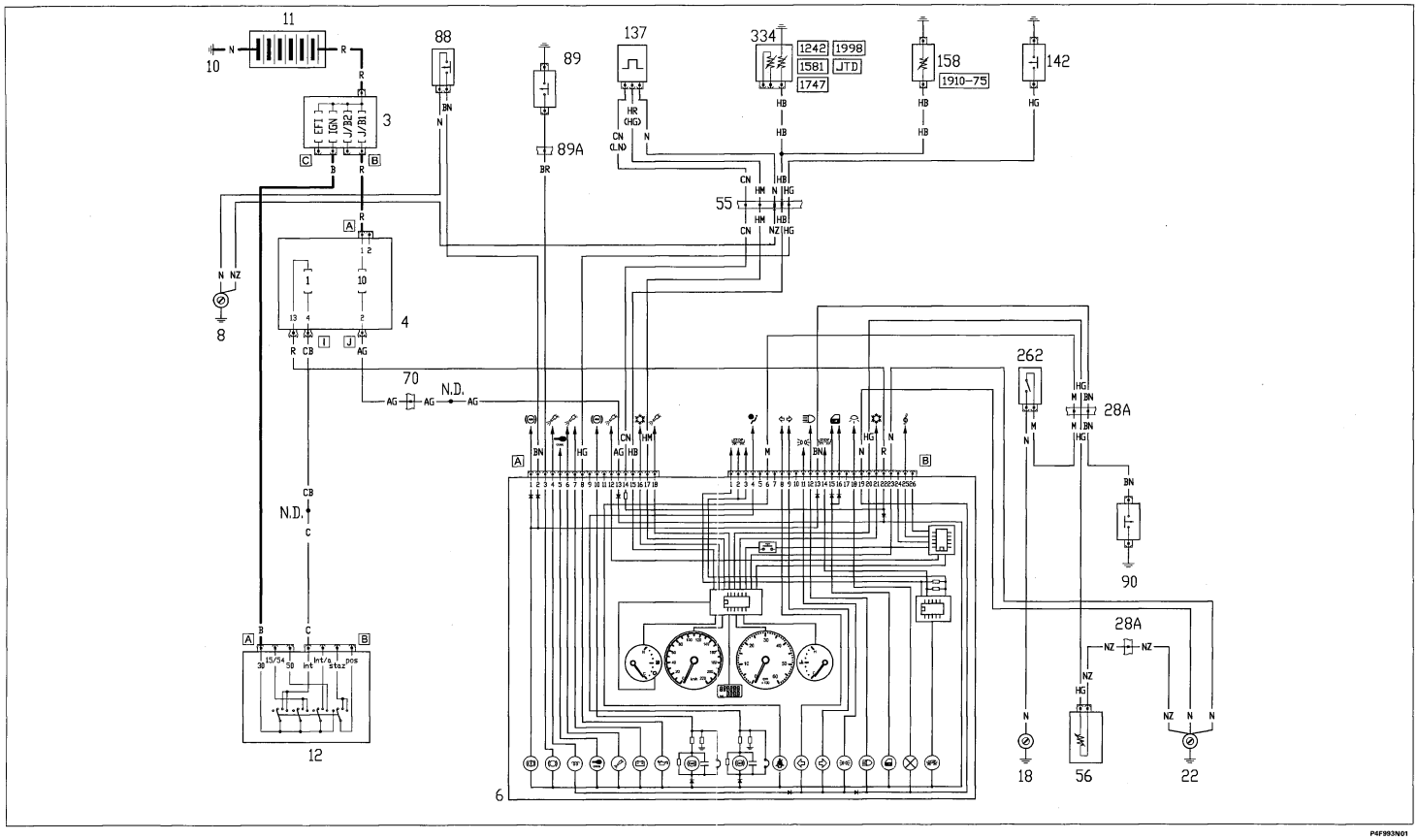

* The cables concerned are marked in the wiring diagram with an asterisk.



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## 55.

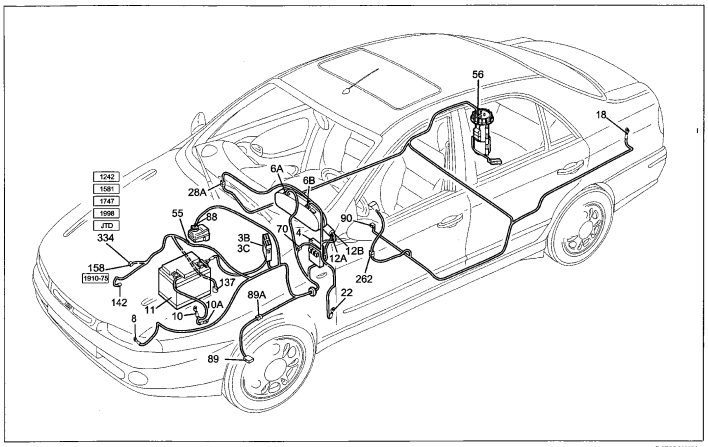
**Instrument panel connections**






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## 55.



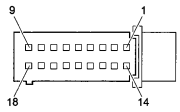

**Instrument panel connections**

Component key

3 Power fusebox
4 Junction unit
6 Instrument panel
8 Left front earth
10 Engine battery earth
11 Battery
12 Ignition switch
18 Left rear earth
22 Left facia earth
28 Connection between facia/rear cables
55 Connection between front/engine cables
56 Fuel level gauge control unit
70 Connection between dashborad/front cables
88 Left brake pad wear sensor
90 Switch signalling handbrake applied
137 Vehicle speed sensor
142 Switch signalling insufficient engine oil pressure
158 Coolant temperature sensor for instrument
262 Seat belt warning light switch
334 Dual engine temperature sending unit

### 6A Instrument panel

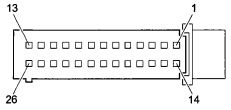
| | | | | | |
|---|---|---|---|---|---|
| 1 | BV 95 | | 12 | VB 190A | 1998 |
| 2 | BN 88 * | | 12 | VB 55A | JTD |
| 3 | BR 89A * | | 12 | VB 160A | 1747 |
| 4 | CL 55 | 1910-75 | 12 | VB 195A | 1581 |
| 4 | CL 55A | JTD | 12 | VB 140A | 1242 |
| 5 | MN 131B | | 13 | AG n.d. * | |
| 6 | LN 190A | 1998 | 14 | CN 55 * | |
| 6 | LN 140A | 1242 | 15 | HB 55 * | |
| 6 | LN 195A | 1581 | 16 | HL 70 | |
| 6 | LN 160A | 1747 | 17 | HM 55 * | |
| 6 | LN 55A | JTD | 17 | L n.d. | JTD |
| 7 | HN 55 | | 18 | L 190A | 1998 |
| 7 | HN n.d. | JTD | 18 | L 160A | 1747 |
| 8 | HG 55 | | 18 | L 195A | 1581 |
| 10 | RV 95 | | 18 | L 140A | 1242 |



P4F994N02

### 6B Instrument panel

| | | | |
|---|---|---|---|
| 1 | RG 4J | 19 | N 22 |
| 2 | RV n.d. | 20 | HG 28A * |
| 3 | RV n.d. | 21 | GL 34A |
| 4 | C 117 | 22 | R 4I * |
| 6 | M 28A * | 23 | N 22 * |
| 8 | A 4H | 25 | VN 48A |
| 9 | AN 4H | | |
| 11 | GN 310A | | |
| 12 | LB 4J | | |
| 13 | BN 28A * | | |
| 14 | RN 4H | | |
| 15 | H 70 | | |
| 15 | H 310C | | |
| 16 | CN 310A | | |
| 18 | GR 58 | | |



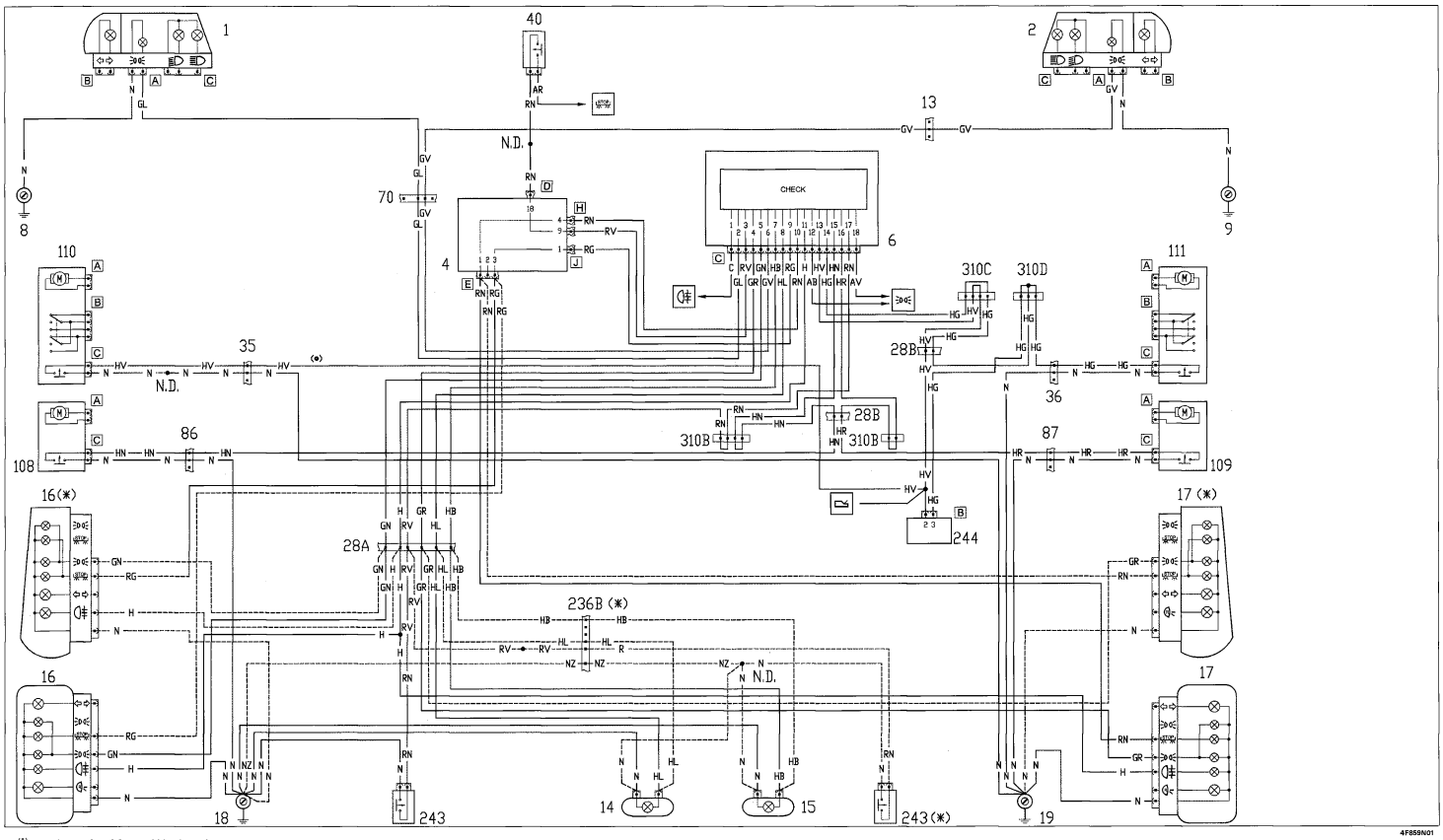
P4F994N03

(*) The cables involved in the wiring diagram are marked with an asterisk.



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**Check Panel connections**



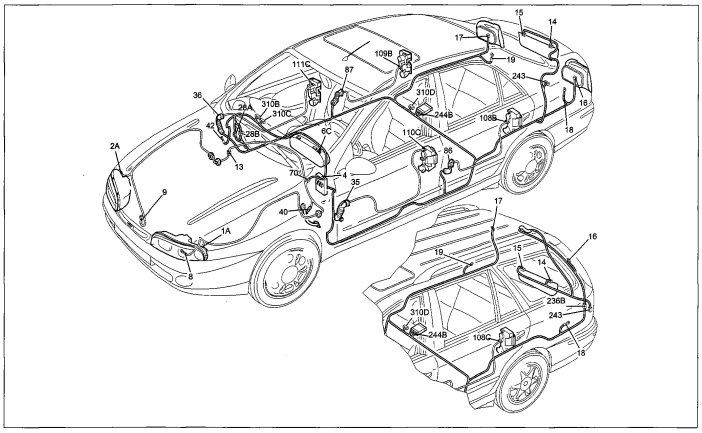

(*) Variants for Marea Weekend

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## 55.

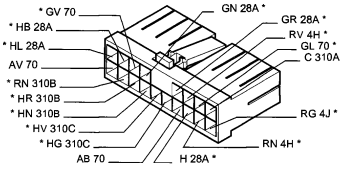



**Check Panel connections**

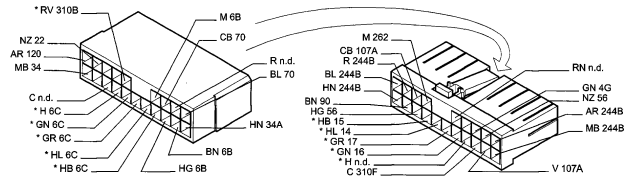
Key to components

1 Left front light cluster
2 Right front light cluster
4 Junction unit
6 Instrument panel
8 Left front earth
9 Right front earth
13 Connection between right/left front cables
14 Left no. plate light
15 Right no. plate light
16 Left rear light cluster
17 Right rear light cluster
18 Left rear earth
19 Right rear earth
28 Connection between dashboard/rear cables
35 Connection between dashboard/left front door cables
36 Connection between dashboard/right front door cables
40 Brake lights control switch
42 Right dashboard earth
70 Connection between dashboard/front cables
86 Connection between rear/left rear door cables
87 Connection between rear/right rear door cables
108 Left rear central locking
109 Right rear central locking
110 Left front central locking
111 Right front central locking
236 Connection between rear cable and tailgate
243 Luggage compartment light button
244 Integrated services electronic control unit
310 Connecting bridge

**6C** Instrument panel

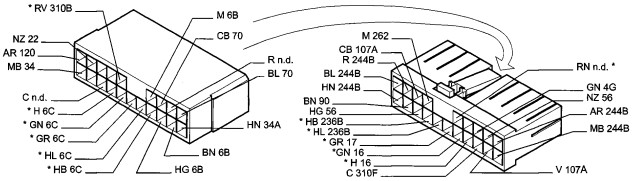



**28A** Connection between dashboard/rear cables



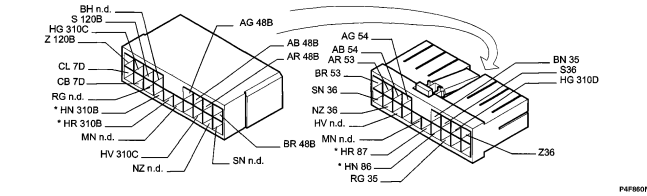

Marea

**28A** Connection between dashboard/rear cables




Marea Weekend

**28B** Connection between dashboard/rear cables

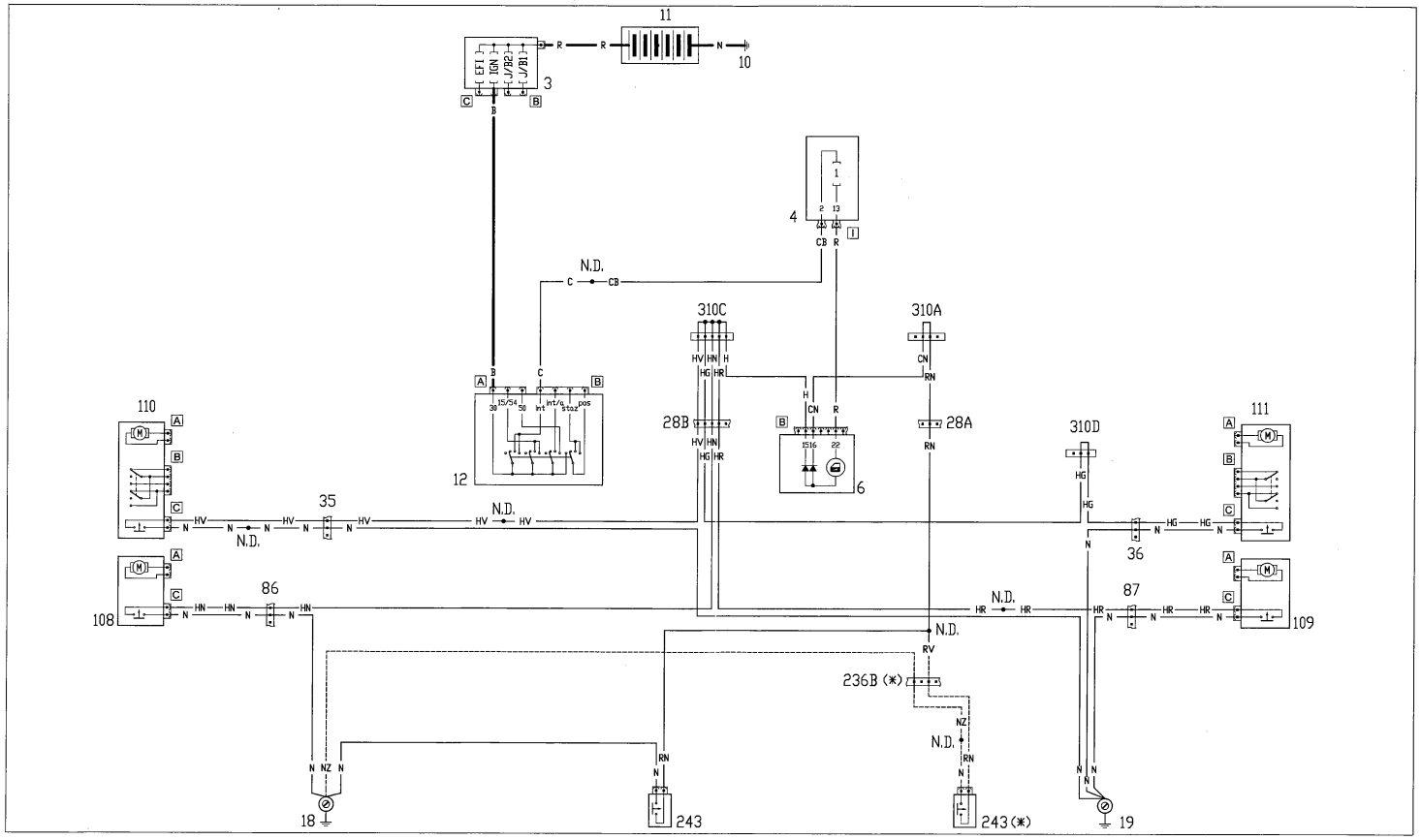



* The cables concerned are marked in the wiring diagram with an asterisk.



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**Door Check device (versions without alarm)**

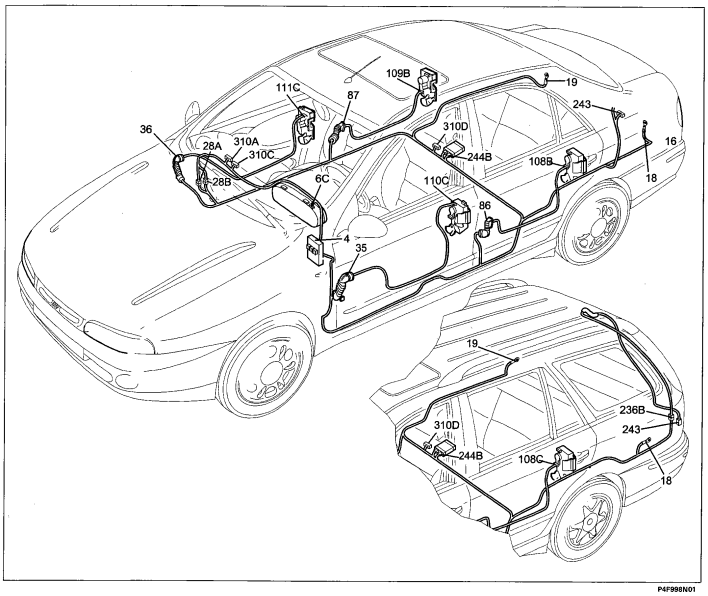



* Variant for Marea Weekend



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## 55.




P4F998N01

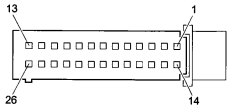
**Door Check device (versions without alarm)**

Component key

4 Junction unit
6 Instrument panel
18 Left rear earth
19 Right rear earth
28 Connection between facia/rear cables
35 Connection between dashboard/left front door cables
36 Connection between dashboard/right front door cables
86 Connection between rear/left rear door cables
87 Connection between rear/right rear door cables
108 Left rear door lock
109 Right rear door lock
110 Left front door lock
111 Right front door lock
236 Connection between rear cables and tailgate
243 Luggage compartment light button
310 Connection bridge

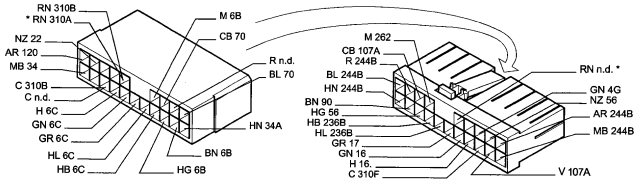
### 6B Instrument panel

| | |
|---|---|
| 1 | RG 4J |
| 2 | RV n.d. |
| 3 | RV n.d. |
| 4 | C 117 |
| 6 | M 28A |
| 8 | A 4H |
| 9 | AN 4H |
| 11 | GN 310A |
| 12 | LB 4J |
| 13 | BN 28A |
| 14 | RN 4H |
| 15 | H 70 * |
| 15 | H 310C * |
| 16 | CN 310A * |
| 18 | GR 58 |
| 19 | N 22 |
| 20 | HG 28A |
| 21 | GL 34A |
| 22 | R 4I * |
| 23 | N 22 |
| 25 | VN 48A |



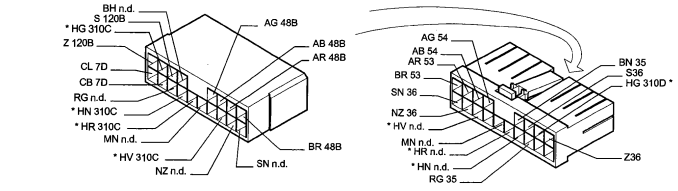

P4F998N02

### 28A Facia/rear lead connection




P4F998N03

### 28B Facia/rear lead connection




P4F998N04

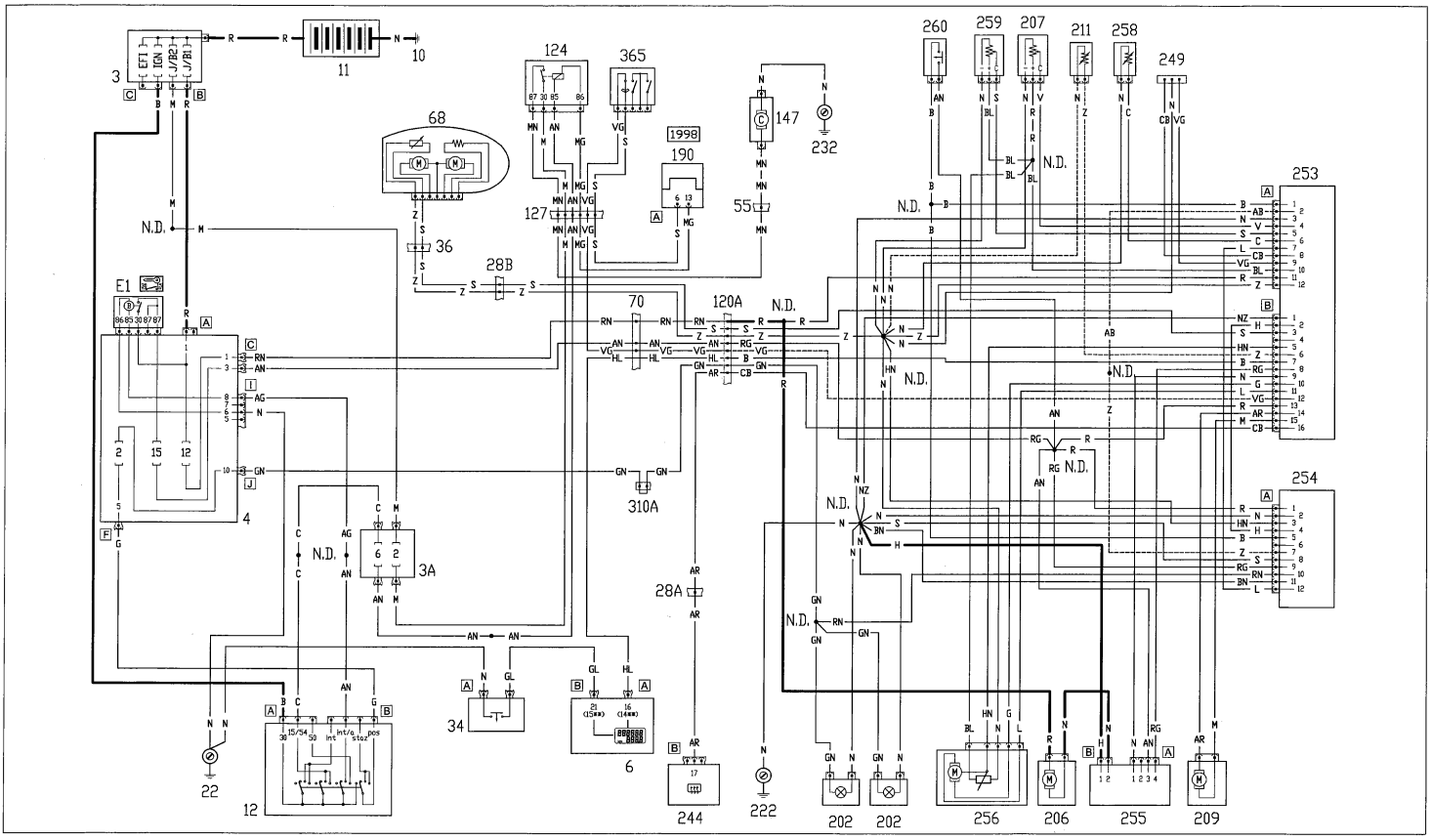
(*) The cables involved in the wiring diagram are marked with an asterisk.



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## 55.

**Climate control unit/heater with thermostatic control (1998)**

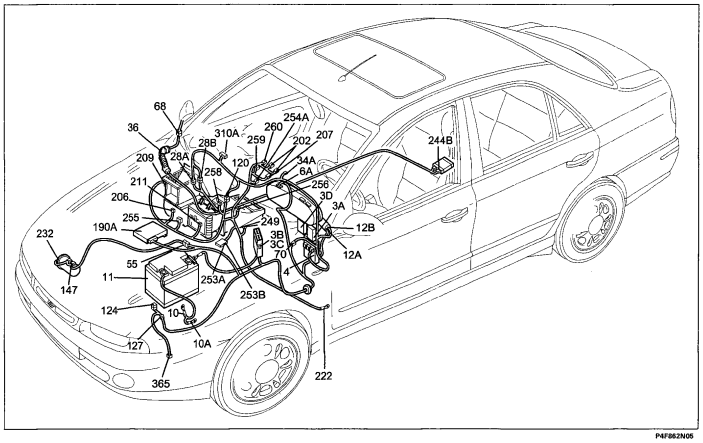



** Variants up to Nov. '99



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## 55.

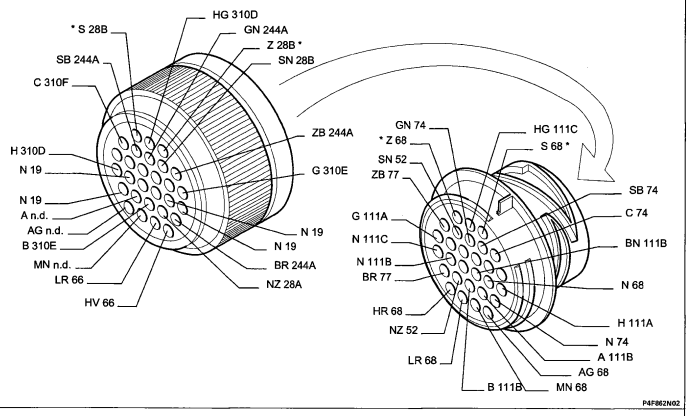



**Climate control unit/heater with thermostatic control (1998)**

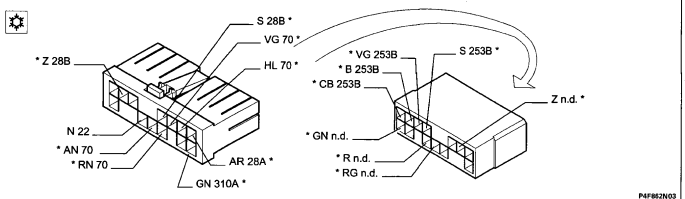
Component key

3 Power fusebox
4 Junction unit
6 Instrument panel
10 Engine battery earth
11 Battery
12 Ignition switch
28 Connection between facia/rear cables
34 Switch control unit
36 Connection between dashboard/right front door cables
55 Connection between front/engine cables
68 Right door mirror
70 Connection between dashborad/front cables
120 Connection for air conditioning unit cables
124 Air condiitoning compressor control relay
127 Connection between front left cable/cable on relay holder bracket
147 Air conditioner compressor
190 Injection/ignition electronic control unit (1998)
202 Heater/air conditioner unit control symbol lighting bulbs
206 Climate control system fan
207 Fan speed adjustment selector
209 Air intake flap control actuator
211 Defroster sensor
222 Earth for air conditioning system
232 Earth for compressor
244 Integrated services control system
249 Tester socket for air conditioner system
253 Air conditioner control unit
254 Climate control system controls with interior temperature sensor
255 Electronic speed variator for climate control fan
256 Air mixing control actuator
258 Treated air temperature sensor
259 Required temperature adjustment solenoid
260 MAX-DEF microswitch
310 Connection bridge
365 Pressostato a 4 livelli

### 36 Connection between dashboard/right front door cables

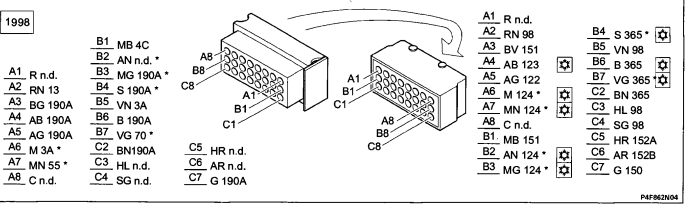



### 120 Connection for air conditioning unit cables




### 127 Connection between front left cable/cable on relay holder bracket

1998



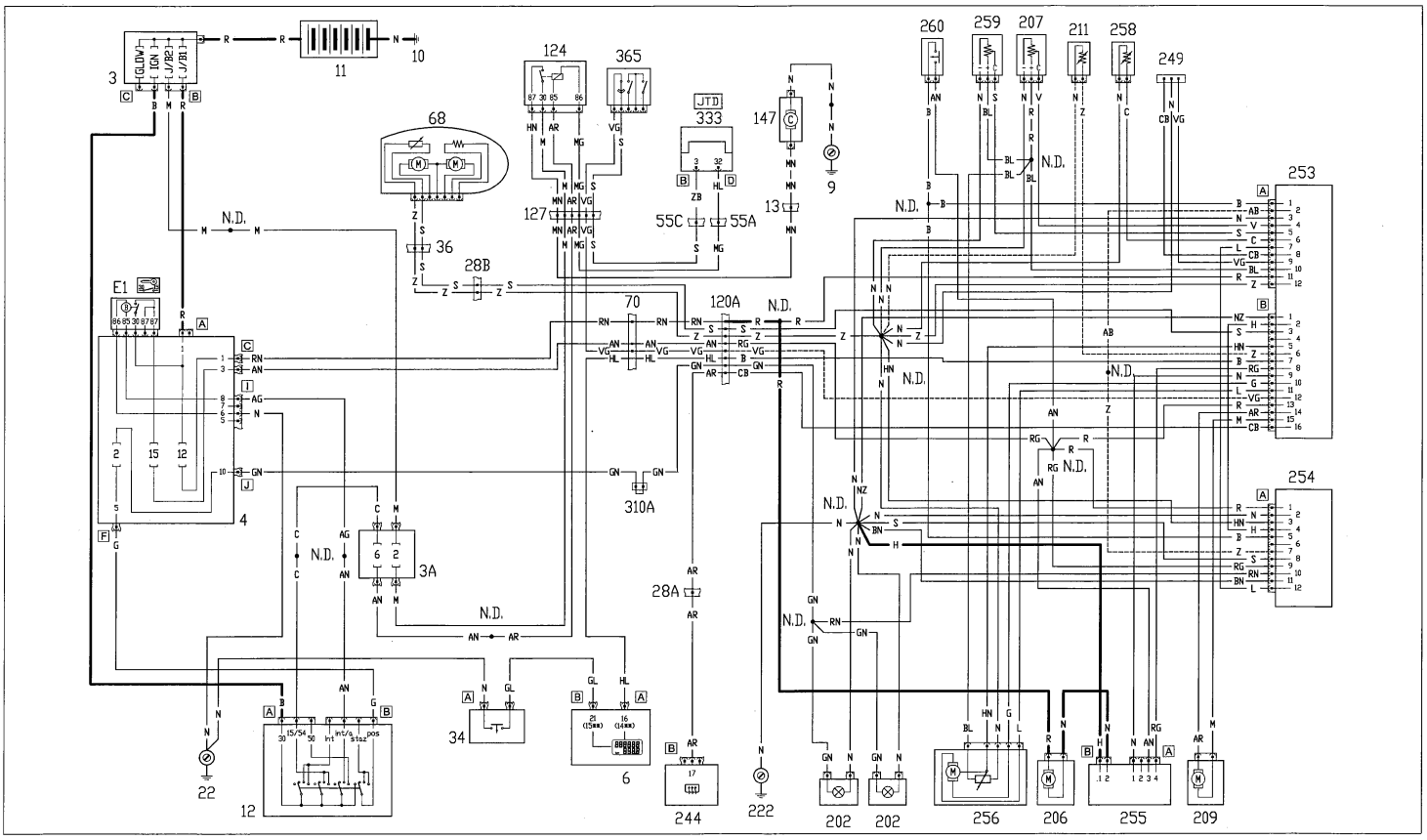

(*) The cables involved in the wiring diagram are marked with an asterisk.



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## 55.

**Climate control system/heater with thermostatic adjustment (1910-2387 JTD)**



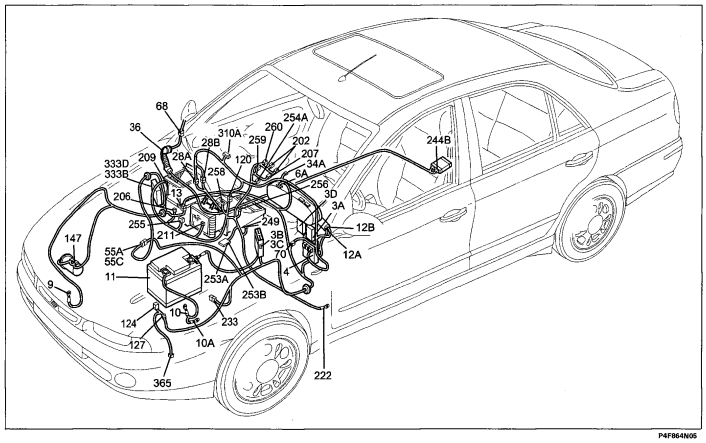

P4F863N02

** Variants up to Nov. '99



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## 55.

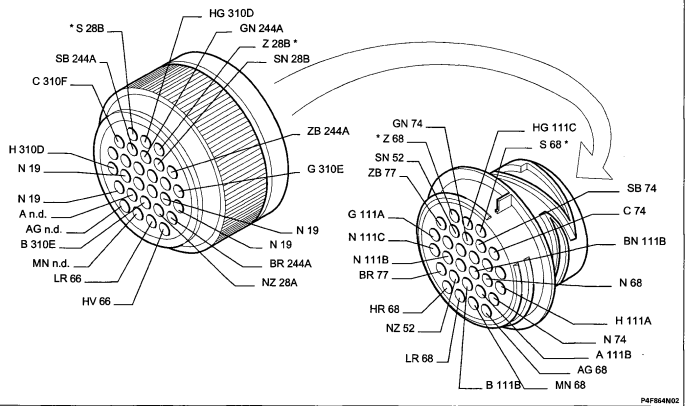



**Climate control system/heater with thermostatic adjustment (1910-2387 JTD)**

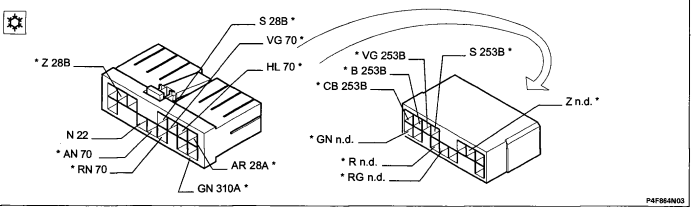
Component key

3 Power fusebox
4 Junction unit:
6 Instrument panel
9 Right front earth
10 Engine battery earth
11 Battery
12 Ignition switch
13 Connection between right/left front cables
28 Connection between facia/rear cables
34 Switch control unit
36 Connection between dashboard/right front door cables
55 Connection between front/engine cables
68 Right door mirror
70 Connection between dashborad/front cables
120 Connection for air conditioning unit cables
124 Air condiitoning compressor control relay
127 Connection between front left cable/cable on relay holder bracket
147 Air conditioner compressor
202 Heater/air conditioner unit control symbol lighting bulbs
206 Climate control system fan
207 Fan speed adjustment selector
209 Air intake flap control actuator
211 Defroster sensor
233 Thermal relay on engine coolant pump
244 Integrated services control system
249 Tester socket for air conditioner system
253 Air conditioner control unit
254 Climate control system controls with interior temperature sensor
255 Electronic speed variator for climate control fan
256 Air mixing control actuator
258 Treated air temperature sensor
259 Required temperature adjustment solenoid
260 MAX-DEF microswitch
310 Connection bridge
333 Injection control unit (JTD)
365 Pressostato a 4 livelli

**36** Connection between dashboard/right front door cables

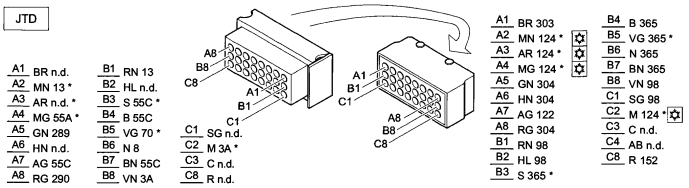



**120** Connection for air conditioning unit cables




**127** Connection between front left cable/cable on relay holder bracket

JTD



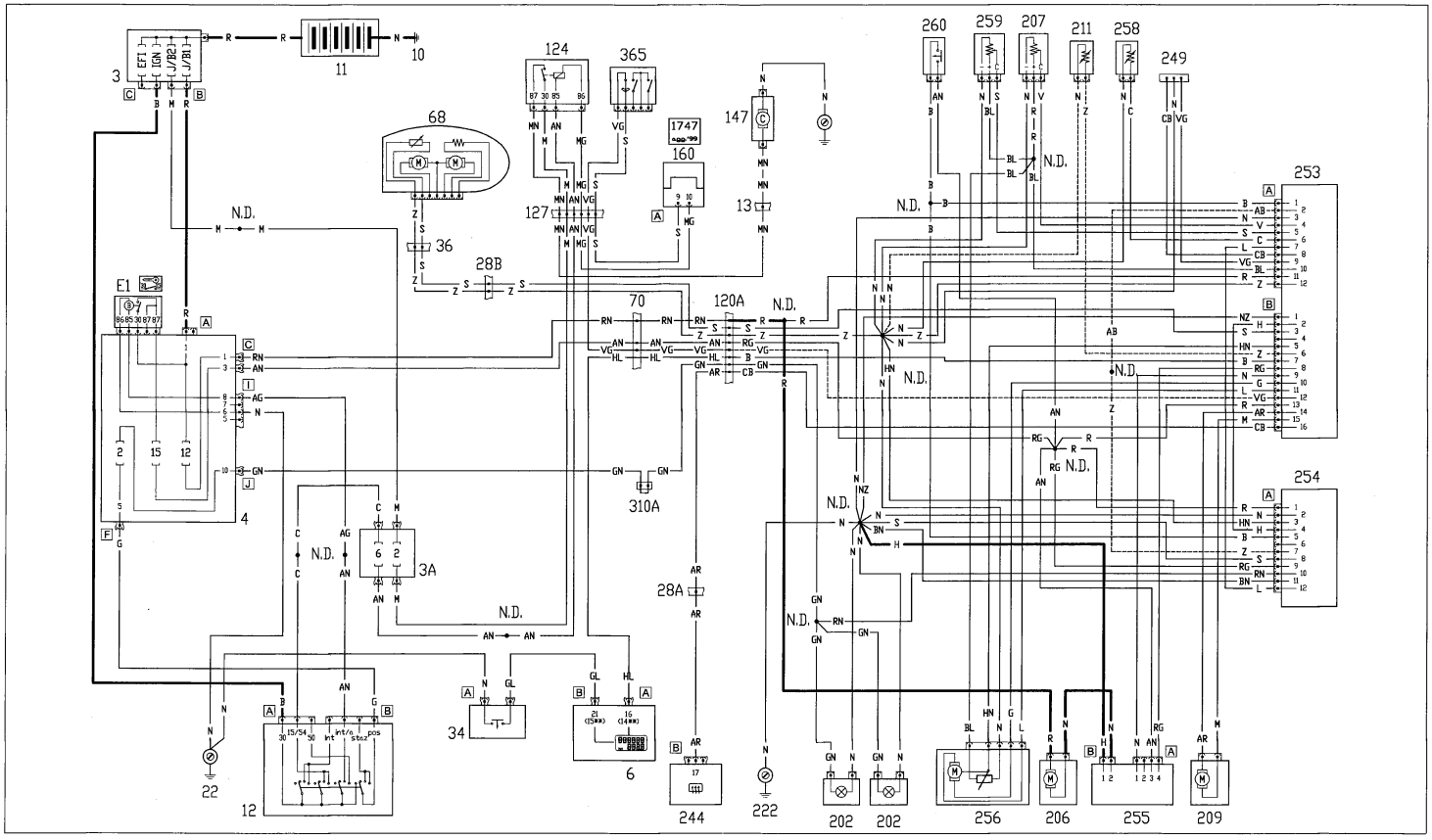

(*) The cables involved in the wiring diagram are marked with an asterisk.



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## 55.

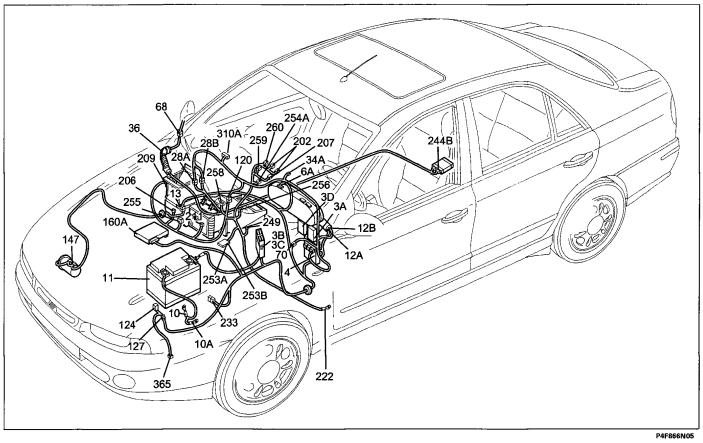
**Climate control system/heater with thermostatic controls (1747 1999 udate)**




** Variants up to Nov. '99



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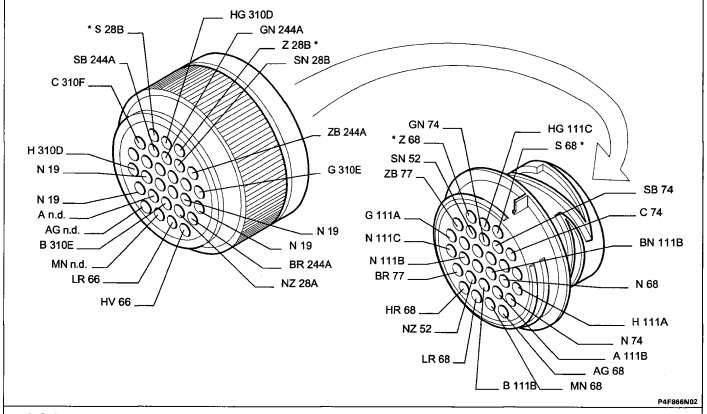



**Climate control system/heater with thermostatic controls (1747 1999 update)**

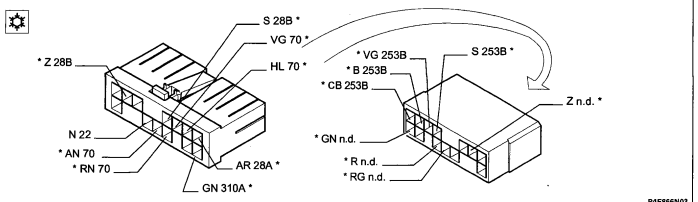
Component key

3 Power fusebox
4 Junction unit
6 Panel
10 Engine battery earth
11 Battery
12 Ignition switch
13 Connection between right/left front cables
28 Connection between facia/rear cables
34 Switch control unit
36 Connection between dashboard/right front door cables
68 Right door mirror
70 Connection between dashborad/front cables
120 Connection for air conditioning unit cables
124 Air condiitoning compressor control relay
127 Connection between front left cable/cable on relay holder bracket
147 Air conditioner compressor
160 Ignition / injection electronic control unit (1747)
202 Heater/air conditioner unit control symbol lighting bulbs
206 Climate control system fan
207 Fan speed adjustment switch
209 Air intake flap control actuator
211 Defroster sensor
222 Earth for air conditioning system
233 Thermal switch on engine coolant pump
244 Integrated services control system
249 Tester socket for air conditioner system
253 Air conditioner control unit
254 Climate control system controls with interior temperature sensor
255 Electronic speed variator for climate control fan
256 Air mixing control actuator
258 Treated air temperature sensor
259 Required temperature adjustment solenoid
260 MAX-DEF microswitch
310 Connection bridge
365 Pressostato a 4 livelli

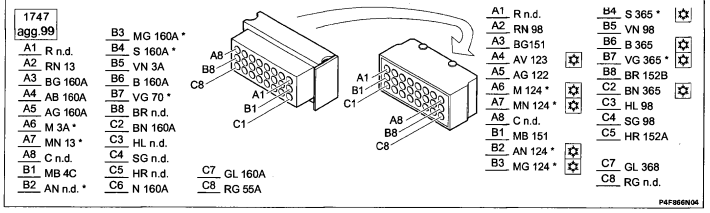
**36** Connection between dashboard/right front door cables




**120** Connection for air conditioning unit cables




**127** Connection between front left cable/cable on relay holder bracket



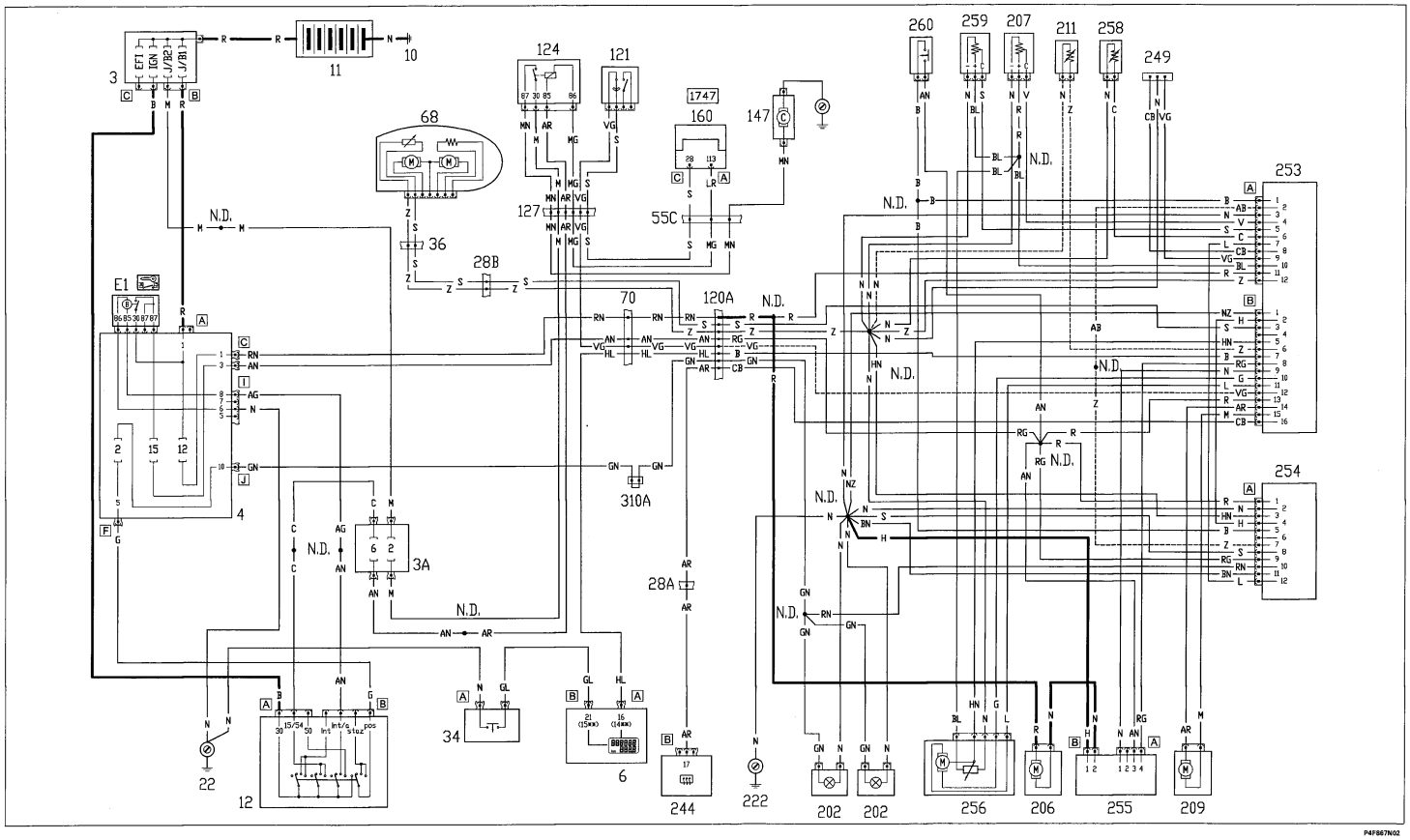

(*) The cables involved in the wiring diagram are marked with an asterisk.



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# 55.

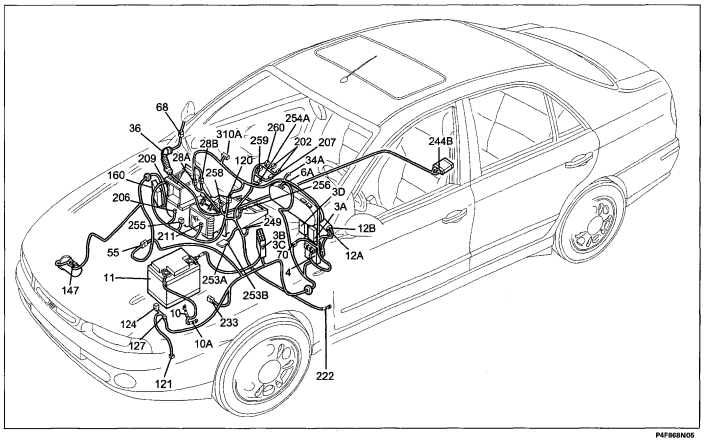
**Climate control system/heater with thermostatic adjustment (1747)**




** Variants up to Nov. '99



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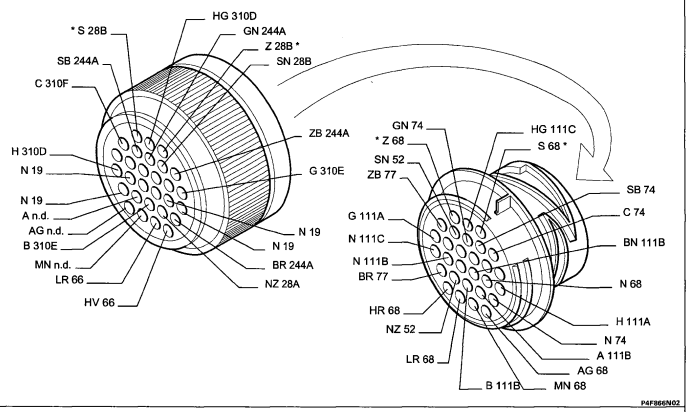

P4F868N05

**Climate control system/heater with thermostatic adjustment (1747)**

Component key

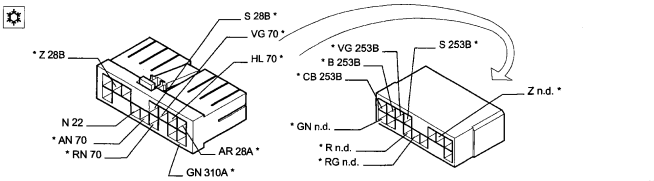
3 Power fusebox
4 Junction unit
6 Instrument panel
10 Engine battery earth
11 Battery
12 Ignition switch
28 Connection between facia/rear cables
34 Switch control unit
36 Connection between dashboard/right front door cables
55 Connection between front/engine cables
68 Right door mirror
70 Connection between dashborad/front cables
120 Connection for air conditioning unit cables
121 Three-stage pressure switch
124 Air condiitoning compressor control relay
127 Connection between front left cable/cable on relay holder bracket
147 Air conditioner compressor
160 Ignition / injection electronic control unit (1747)
202 Heater/air conditioner unit control symbol lighting bulbs
206 Climate control system fan
207 Fan speed adjustment switch
209 Air intake flap control actuator
211 Defroster sensor
222 Earth for air conditioning system
233 Thermal switch on engine coolant pump
244 Integrated services control system
249 Tester socket for air conditioner system
253 Air conditioner control unit
254 Climate control system controls with interior temperature sensor
255 Electronic speed variator for climate control fan
256 Air mixing control actuator
258 Treated air temperature sensor
259 Required temperature adjustment solenoid
260 MAX-DEF microswitch
310 Connection bridge

**36** Connection between dashboard/right front door cables



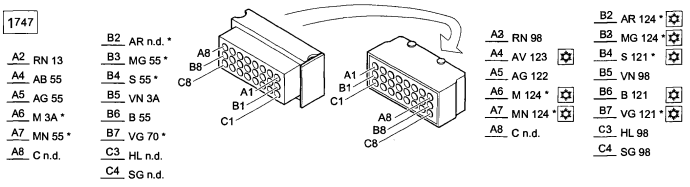

P4F866N02

**120** Connection for air conditioning unit cables




P4F866N03

**127** Connection between front left cable/cable on relay holder bracket




P4F866N04

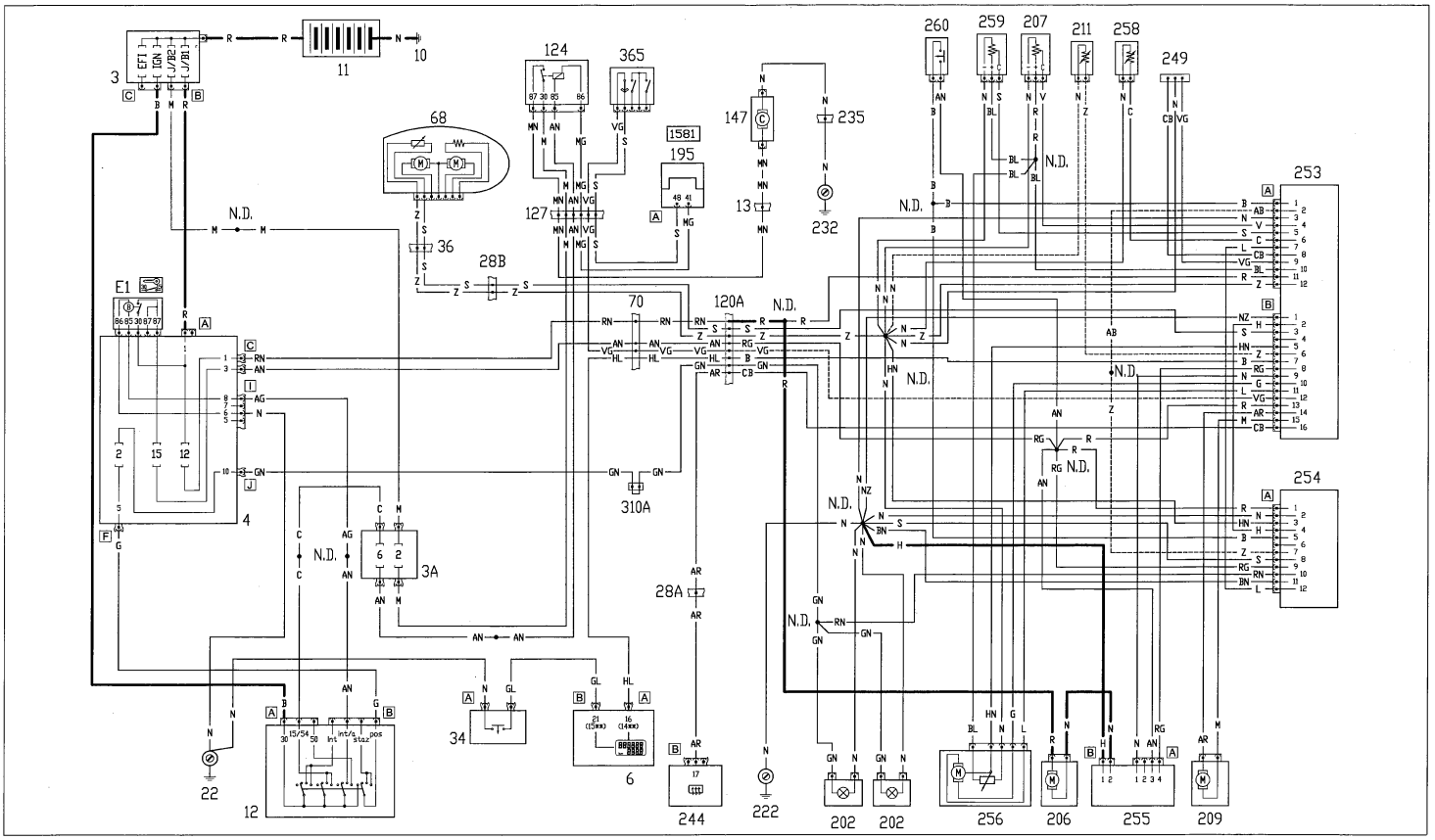
(*) The cables involved in the wiring diagram are marked with an asterisk.



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## 55.

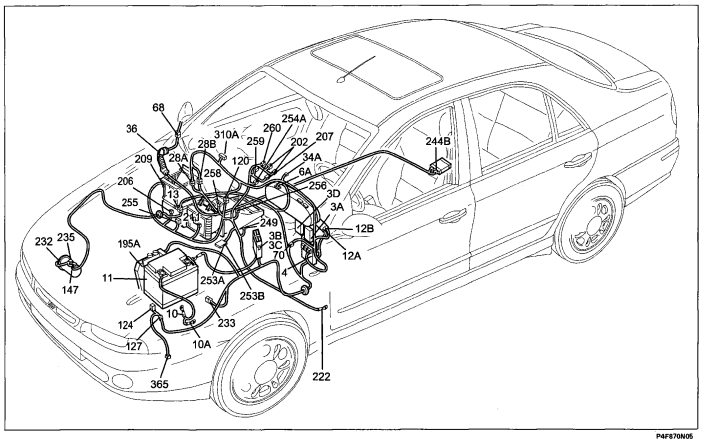
**Climate control system/heater with thermostatic adjustment (1581)**




** Variants up to Nov. '99



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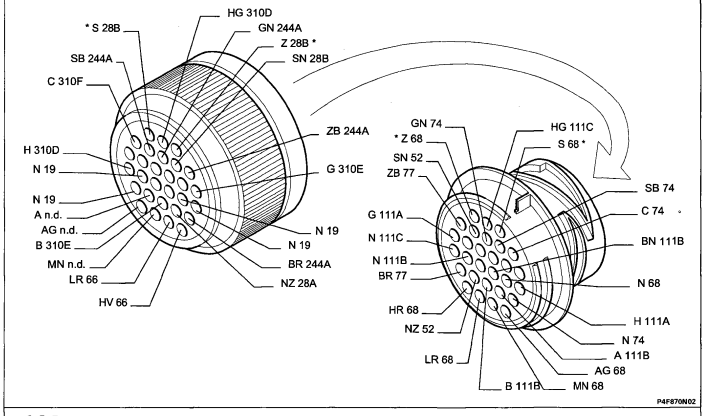

P4F870N05

**Climate control system/heater with thermostatic adjustment (1581)**

Component key

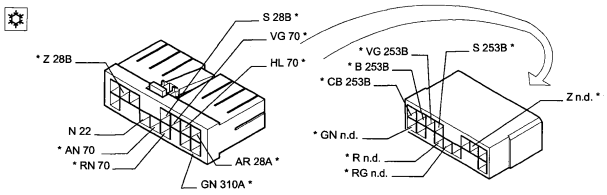
3 Power fusebox
4 Junction unit
6 Instrument panel
10 Engine battery earth
11 Battery
12 Ignition switch
13 Connection between right/left front cables
28 Connection between facia/rear cables
34 Switch control unit
36 Connection between dashboard/right front door cables
68 Right door mirror
70 Connection between dashborad/front cables
120 Connection for air conditioning unit cables
124 Air condiitoning compressor control relay
127 Connection between front left cable/cable on relay holder bracket
147 Air conditioner compressor
195 Ignition / injection control unit. (1581)
202 Heater/air conditioner unit control symbol lighting bulbs
206 Climate control system fan
207 Fan speed adjustment switch
209 Air intake flap control actuator
211 Defroster sensor
222 Earth for air conditioning system
232 Earth for compressor
233 Thermal switch on engine coolant pump
235 Connection for air conditioning compressor cables
244 Integrated services control system
249 Tester socket for air conditioner system
253 Air conditioner control unit
254 Climate control system controls with interior temperature sensor
255 Electronic speed variator for climate control fan
256 Air mixing control actuator
258 Treated air temperature sensor
259 Required temperature adjustment solenoid
260 MAX-DEF microswitch
310 Connection bridge
365 Pressostato a 4 livelli

**36** Connection between dashboard/right front door cables



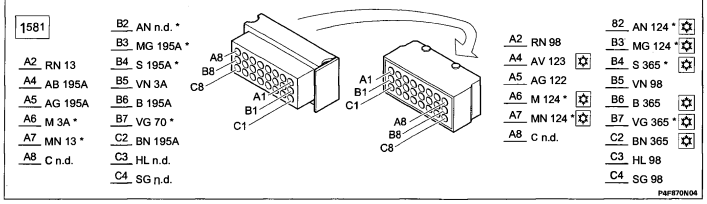

P4F870N02

**120** Connection for air conditioning unit cables




P4F870N03

**127** Connection between front left cable/cable on relay holder bracket




P4F870N04

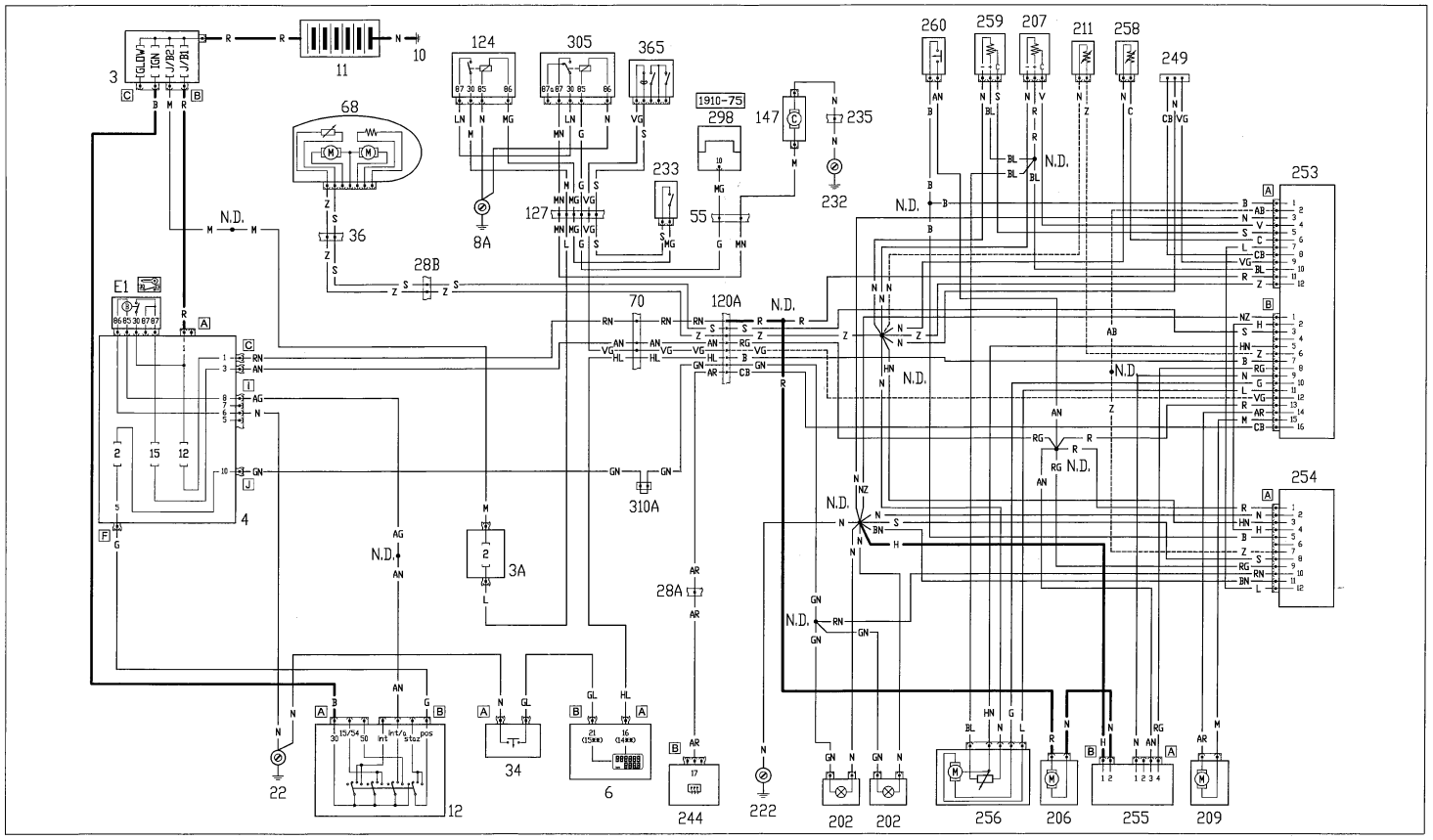
(*) The cables involved in the wiring diagram are marked with an asterisk.



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## 55.

**Climate control system/heater with thermostatic adjustment (1910 - 75)**

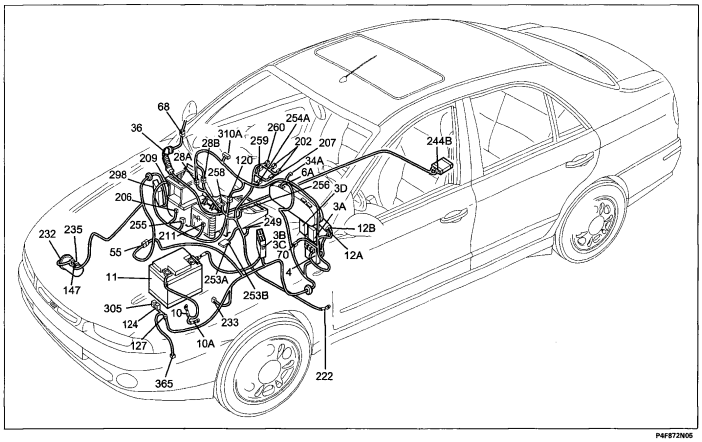



** Variants up to Nov. '99



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## 55.

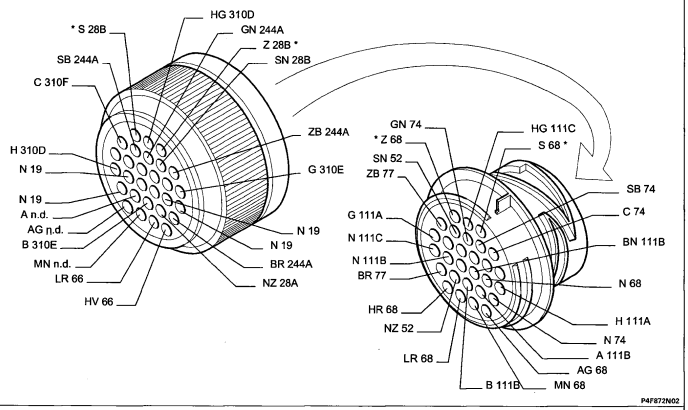



**Climate control system/heater with thermostatic adjustment (1910 - 75)**

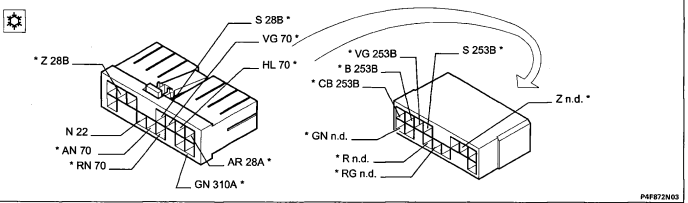
Component key

3 Power fusebox
4 Junction unit
6 Instrument panel
10 Engine battery earth
11 Battery
12 Ignition switch
28 Connection between facia/rear cables
34 Switch control unit
36 Connection between dashboard/right front door cables
55 Connection between front/engine cables
68 Right door mirror
70 Connection between dashborad/front cables
120 Connection for air conditioning unit cables
124 Air condiitoning compressor control relay
127 Connection between front left cable/cable on relay holder bracket
147 Air conditioner compressor
202 Heater/air conditioner unit control symbol lighting bulbs
206 Climate control system fan
207 Fan speed adjustment switch
209 Air intake flap control actuator
211 Defroster sensor
222 Earth for air conditioning system
232 Earth for compressor
233 Thermal switch on engine coolant pump
235 Air conditioner compressor lead connection
244 Integrated services control system
249 Tester socket for air conditioner system
253 Air conditioner control unit
254 Climate control system controls with interior temperature sensor
255 Electronic speed variator for climate control fan
256 Air mixing control actuator
258 Treated air temperature sensor
259 Required temperature adjustment solenoid
260 MAX-DEF microswitch
298 EGR electronic control unit (1910TD-75)
310 Connection bridge
365 Pressostato a 4 livelli

**36** Connection between dashboard/right front door cables



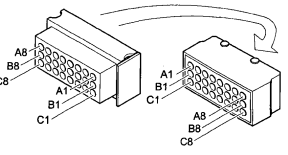

**120** Connection for air conditioning unit cables




**127** Connection between front left cable/cable on relay holder bracket

1910-75

| | | | | | |
|---|---|---|---|---|---|
| A2 | MN 55 * | C1 | SG n.d. | A2 | MN 305 * | C1 | SG 98 |
| A4 | MG 233 * | C2 | L 3A * | A4 | MG 124 * | C2 | M 124 * |
| B1 | RN 13 | C3 | C n.d. | B1 | RN 98 | C3 | C n.d. |
| B2 | HL n.d. | C5 | V 55 | B2 | HL 98 | C5 | V 370 |
| B3 | S 233 * | C6 | MB 4C | B3 | S 365 * | C6 | MB 370 |
| B5 | VG 70 * | C7 | G 55 * | B5 | VG 365 * | C7 | MG 305 * |
| B8 | VN 3A | | | B8 | VN 98 | | |



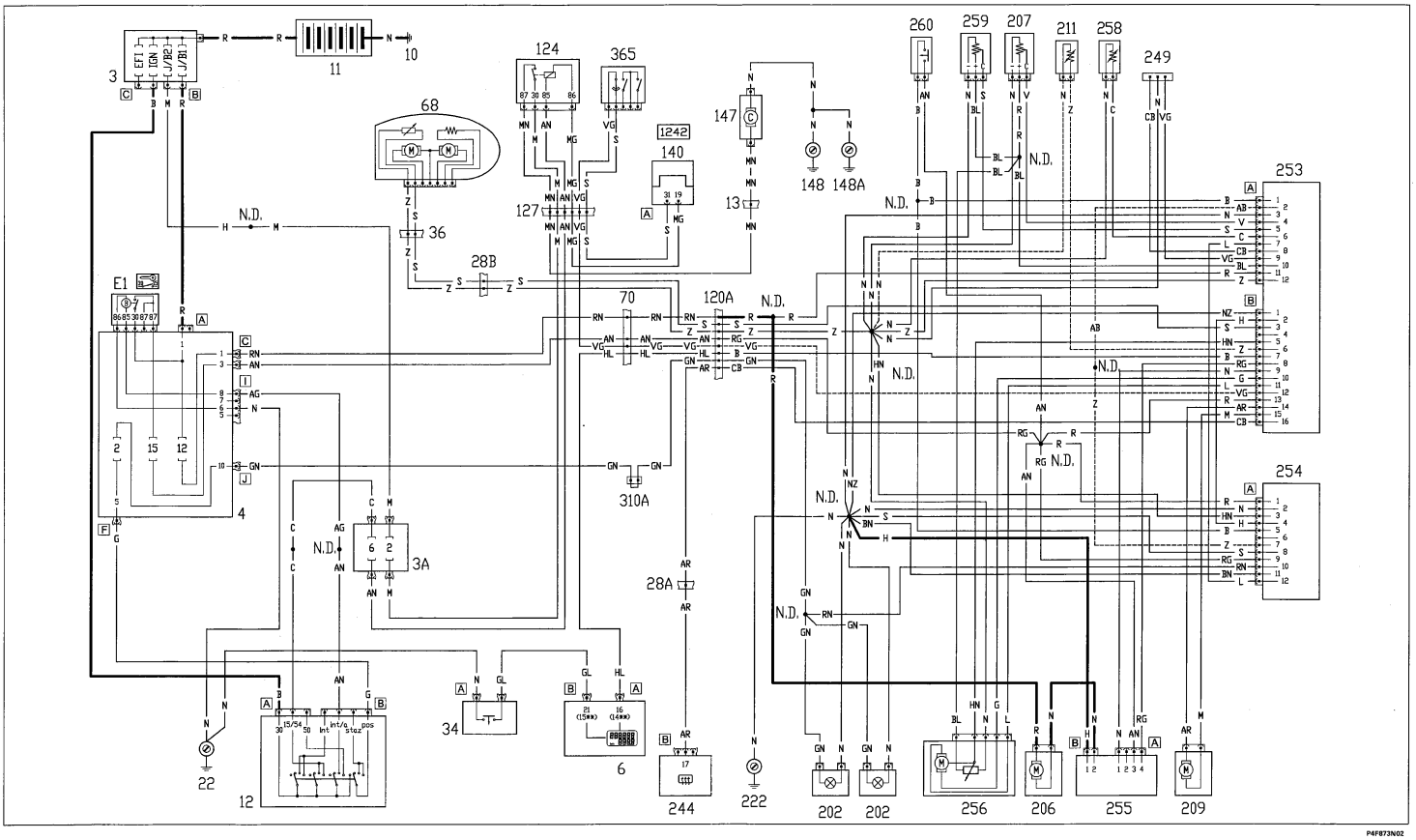

(*) The cables involved in the wiring diagram are marked with an asterisk.



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## 55.

**Climate control system/heater with thermostatic adjustment (1242)**

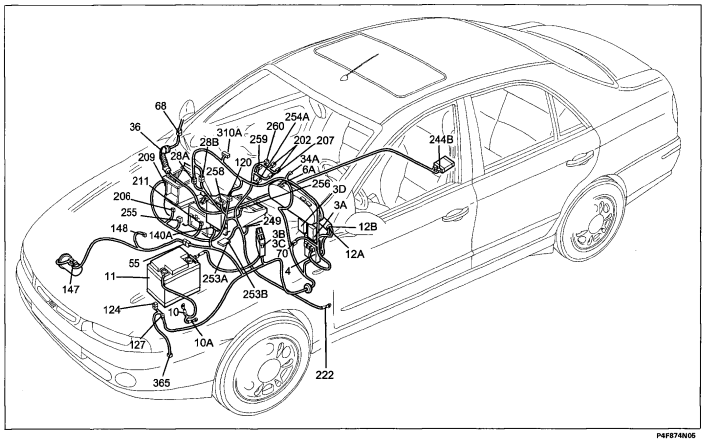



** Variants up to Nov. '99



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## 55.

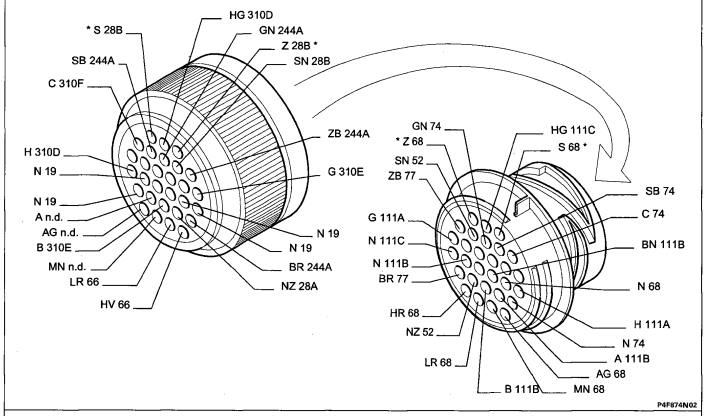



**Climate control system/heater with thermostatic adjustment (1242)**

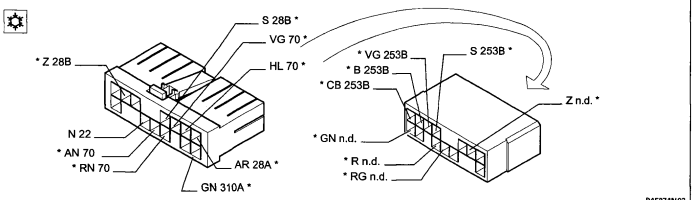
Component key

3 Power fusebox
4 Junction unit
6 Instrument panel
10 Engine battery earth
11 Battery
12 Ignition switch
28 Connection between facia/rear cables
34 Switch control unit
36 Connection between dashboard/right front door cables
55 Connection between front/engine cables
68 Right door mirror
70 Connection between dashborad/front cables
120 Connection for air conditioning unit cables
124 Air condiitoning compressor control relay
127 Connection between front left cable/cable on relay holder bracket
140 Injection/ignition control unit (1242)
147 Air conditioner compressor
202 Heater/air conditioner unit control symbol lighting bulbs
206 Climate control system fan
207 Fan speed adjustment switch
209 Air intake flap control actuator
211 Defroster sensor
222 Earth for air conditioning system
244 Integrated services control system
249 Tester socket for air conditioner system
253 Air conditioner control unit
254 Climate control system controls with interior temperature sensor
255 Electronic speed variator for climate control fan
256 Air mixing control actuator
258 Treated air temperature sensor
259 Required temperature adjustment solenoid
260 MAX-DEF microswitch
310 Connection bridge
365 Pressostato a 4 livelli

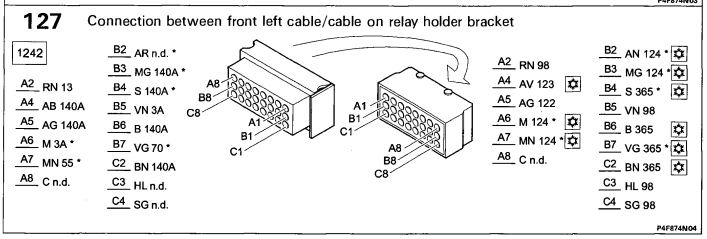
**36** Connection between dashboard/right front door cables




**120** Connection for air conditioning unit cables




**127** Connection between front left cable/cable on relay holder bracket



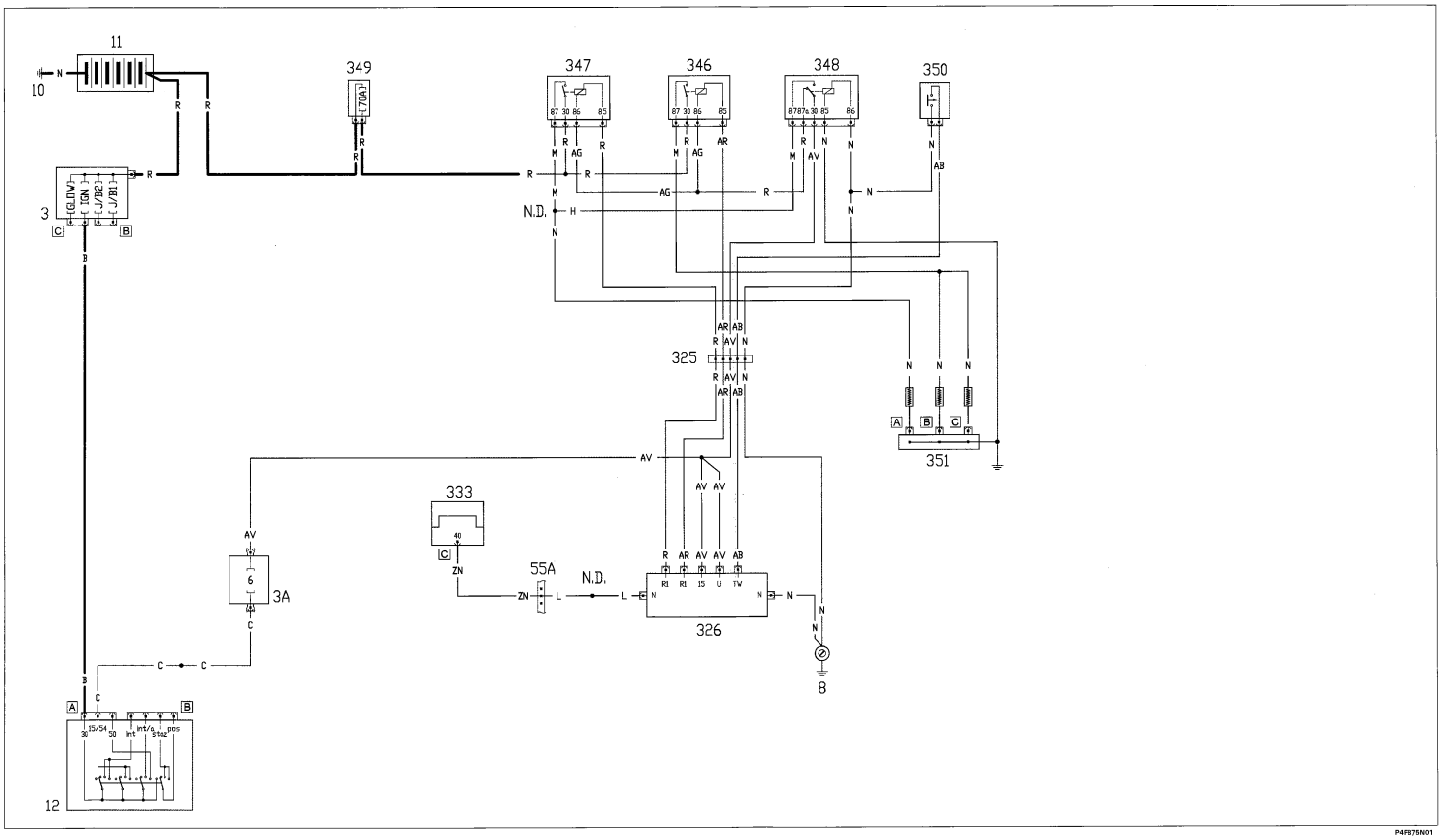

(*) The cables involved in the wiring diagram are marked with an asterisk.



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# 55.

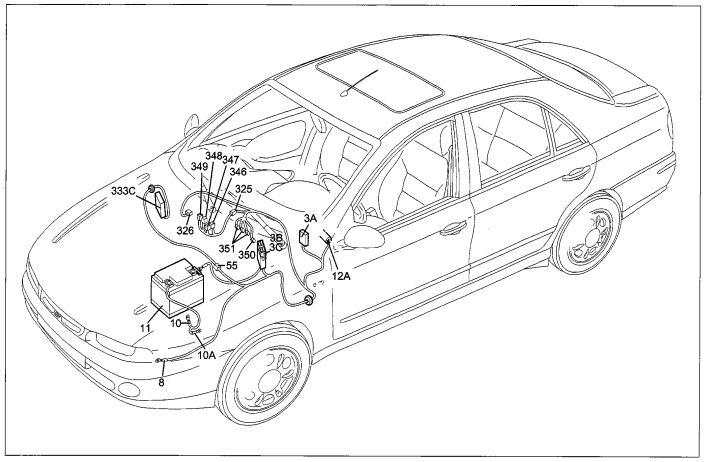
**Additional heater (JTD)**




P4F875N01



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P4F876N01

**Additional heater (JTD)**

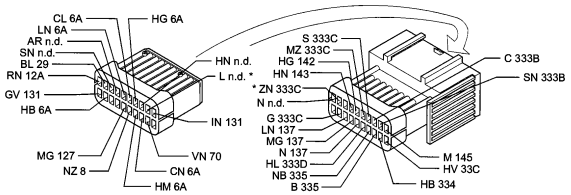
Key to components

3 Power fuse box
8 Left front earth
10 Battery earth on engine
11 Battery
12 Ignition switch
55 Connection between front/engine cables
325 Connection for additional heater
326 Additional heater control unit
333 Injection control unit (JTD)
346 Additional heater relay
347 Additional heater relay
348 Additional heater remote control switch
349 Additional heater protective fuse
350 Additional heater sensor
351 Additional heater heater plug

## 55.

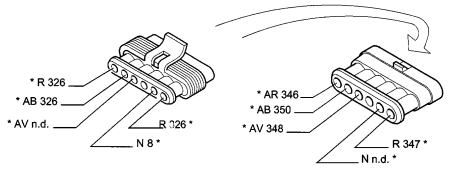
### 55A Connection between front/engine cables

JTD



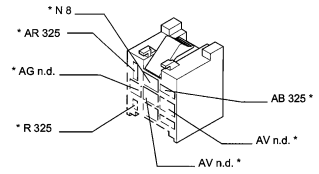

P4F876N02

### 325 Additional heater connection



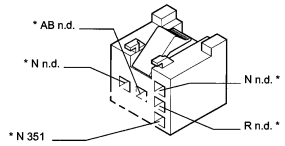

P4F876N03

### 326 Additional heater control unit




P4F876N04

### 348 Additional heater remote control switch




P4F876N05

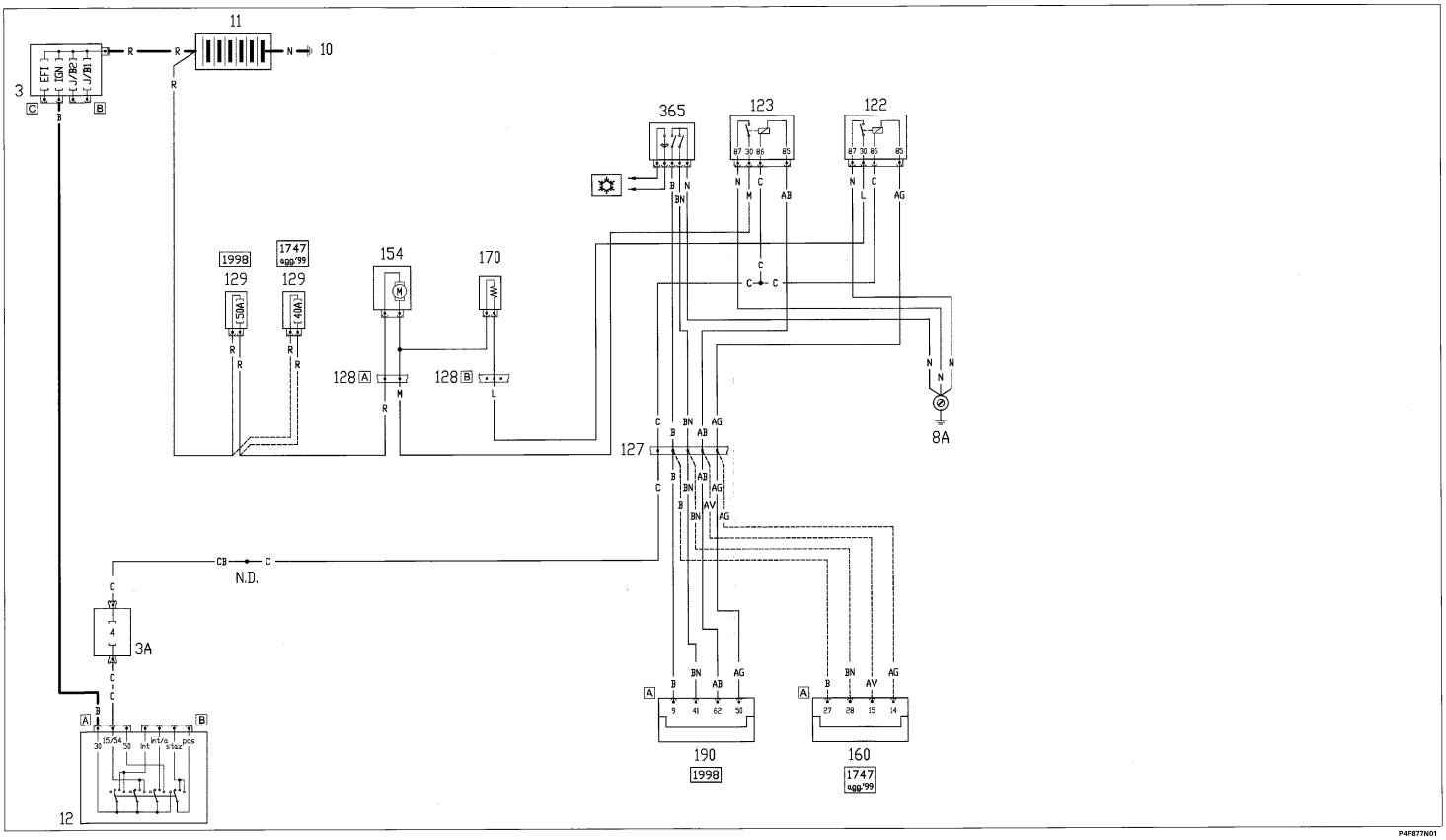
The cables concerned are marked in the wiring diagram with a circle



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## 55.

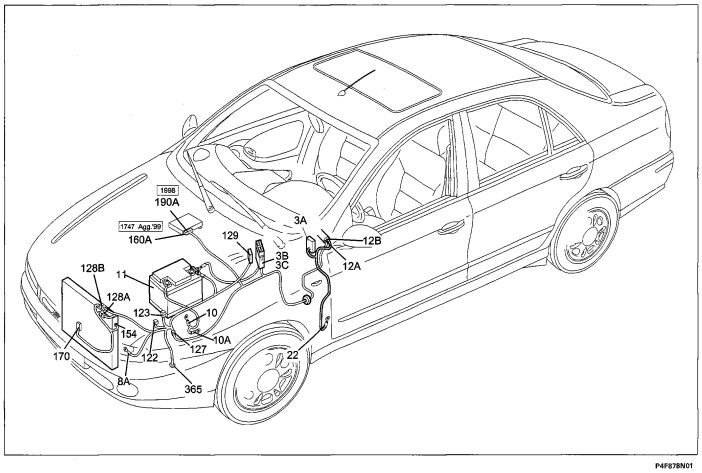
**Versions with climate control**
**Engine cooling ( 1998 - 1797 engines '99 update)**






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## 55.



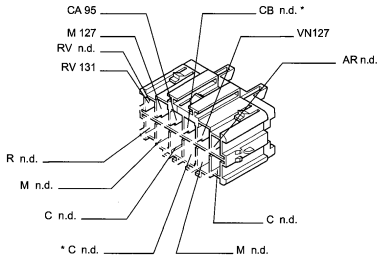

P4F878N01

**Versions with climate control**
**Engine cooling ( 1998 - 1797 engines '99 update)**

Key to components

3 Power fuse box
8 Left front earth
10 Battery earth on engine
11 Battery
12 Ignition switch
22 Left facia earth
122 Engine cooling fan low speed relay
123 Engine cooling fan high speed timer
127 Connection between left front cable/cable on relay holder bracket
129 Engine cooling fan protective power fuse
154 Engine cooling fan
160 Injection/ignition electronic control unti (1747)
170 Resistor for engine cooling fan
190 Injection/ignition electronic control unit (1998)
365 4 stage pressure switch

**3A** Power fuse box

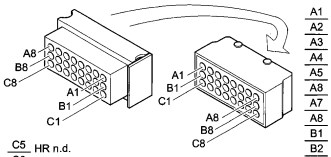



P4F878N02

**127** Connection between left front cable/cable on relay holder bracket

1998

A1 R n.d.
A2 RN 13
A8 BG 190A
A4 AB 190A *
A5 AG 190A *
A6 M 3A
A7 MN 55
A8 C n.d. *
B1 MB 4C
B2 AN n.d.
B3 MG 190A
B4 S 190A
B5 VN 3A
B6 B 190A *
B7 VG 70
C2 BN190A *
C3 HL n.d.
C4 SG n.d.
C5 HR n.d.
C6 AR n.d.
C7 G 190A



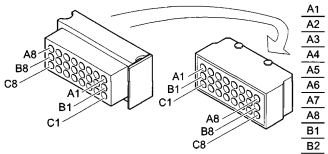

A1 R n.d.
A2 RN 98
A3 BV 151
A4 AB 123 *
A5 AG 122 *
A8 M 124
A7 MN 124
A8 C n.d. *
B1 MB 151
B2 AN 124
B8 MG 124
B4 S 365
B5 VN 98
B6 B 365 *
B7 VG 365 *
C2 BN 365
C3 HL 98
C4 SG 98
C5 HR 152A
C6 AR 152B
C7 G 150

P4F878N03

**127** Connection between left front cable/cable on relay holder bracket

1747 agg.99

A1 R n.d.
A2 RN 13
A3 BG 160A
A4 AB 160A *
A5 AG 160A *
A6 M 3A
A7 MN 13
A8 C n.d. *
B1 MB 4C
B2 AN n.d.
B3 MG 160A
B4 S 160A
B5 VN 3A
B6 B 160A *
B7 VG 70
B8 BR n.d.
C2 BN 160A *
C3 HL n.d.
C4 SG n.d.
C5 HR n.d.
C6 N 160A
C7 GL 160A
C8 RG 55A




A1 R n.d.
A2 RN 98
A3 BG151
A4 AV 123 *
A5 AG 122 *
A6 M 124
A7 MN 124
A8 C n.d. *
B1 MB 151
B2 AN 124
B3 MG 124
B4 S 365
B5 VN 98
B6 B 365 *
B7 VG 365
B8 BR 152B
C2 BN 365 *
C3 HL 98
C4 SG 98
C5 HR 152A
C7 GL 368
C8 RG n.d.

P4F878N04

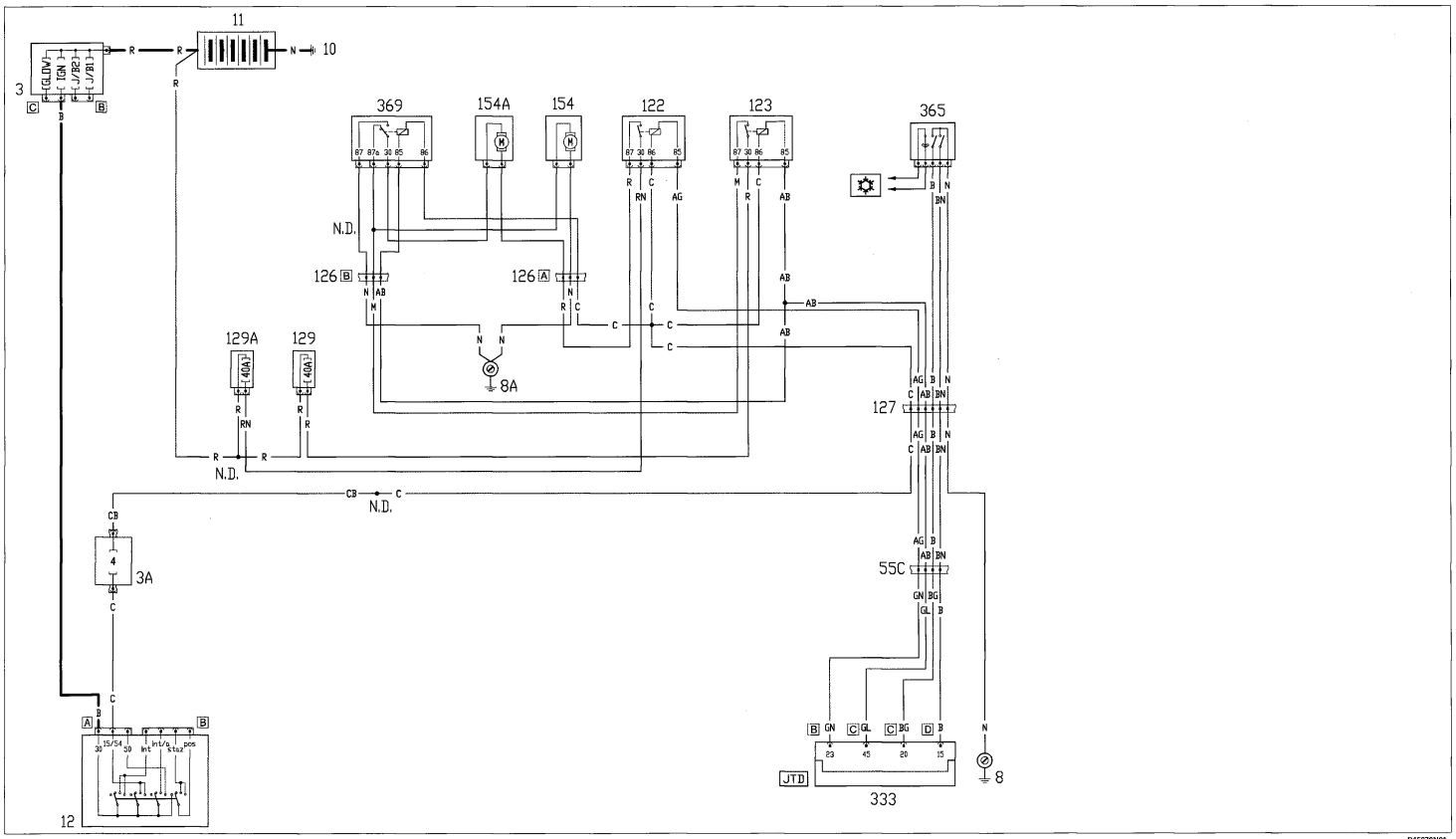
* The cables concerned are marked in the wiring diagram with an asterisk.



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## 55.

**Engine cooling (2387 JTD)**



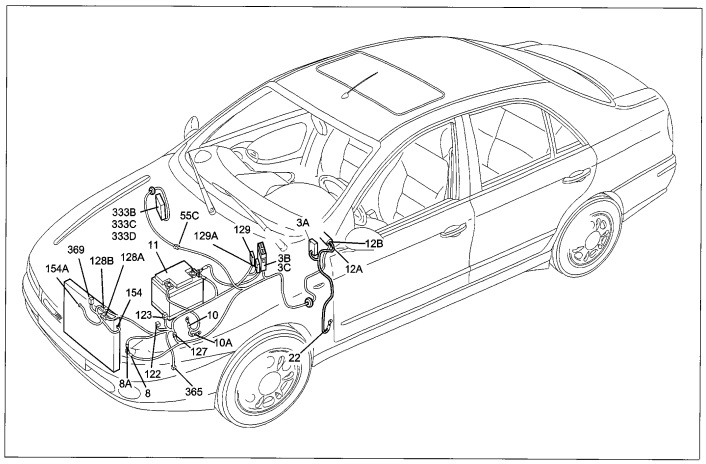

P4F879N01

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## 55.



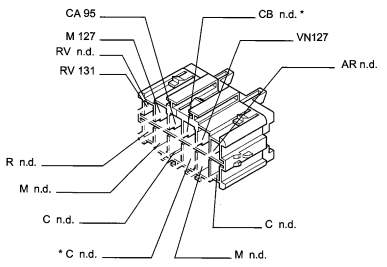

P4F880N01

**Engine cooling (2387 JTD)**

**Key** to components

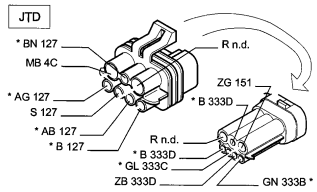
3 Power fuse box
8 Left front earth
10 Battery earth on engine
11 Battery
12 Ignition switch
22 Left facia earth
55 Connection between front/engine cables
122 Engine cooling fan low speed relay
123 Engine cooling fan high speed timer
127 Connection between left front cable/cable on relay holder bracket
128 Connection between front/radiator cables
129 Engine cooling fan protective power fuse
154 Engine cooling fan
333 Injection control unit (JTD)
365 4 stage pressure switch
369 Engine cooling fan remote control switch

### 3A Power fuse box



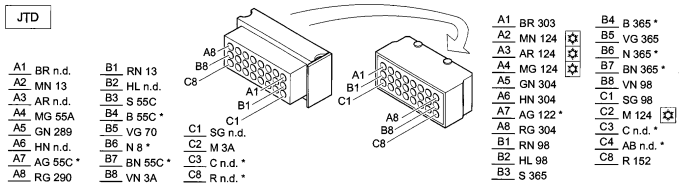

P4F880N02

### 55C Connection between front/engine cables




P4F880N03

### 127 Connection between left front cable/cable on relay holder bracket




P4F880N04

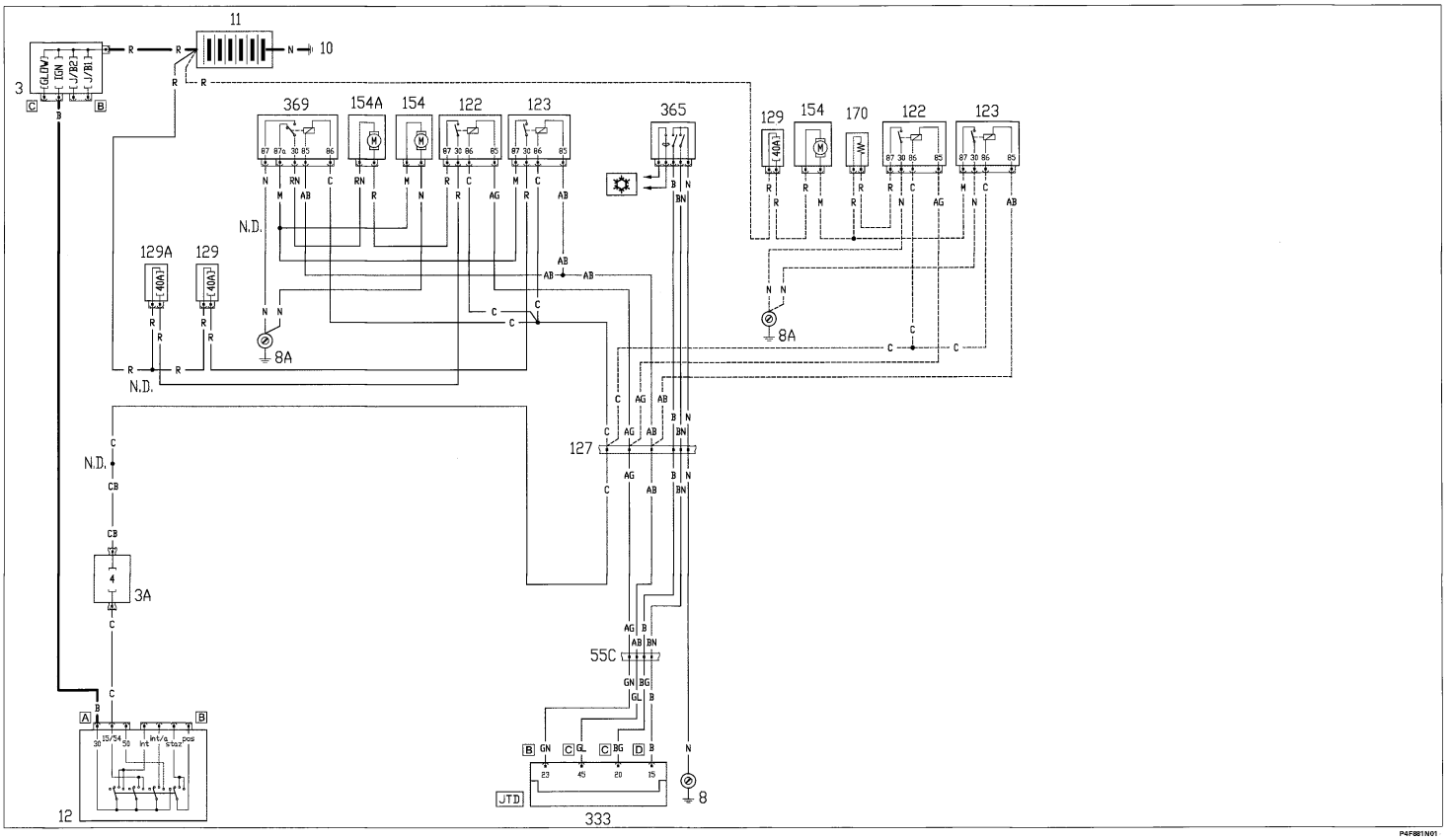
* The cables concerned are marked in the wiring diagram with an asterisk.



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## 55.

**Engine cooling (1910 JTD)**

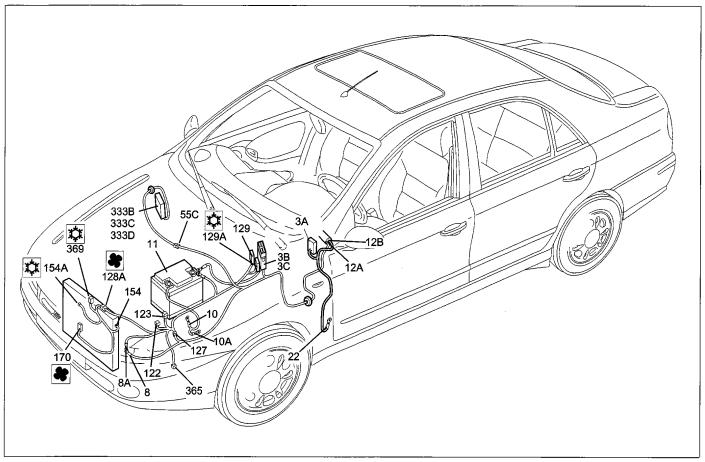



--- Version without air conditioning



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## 55.



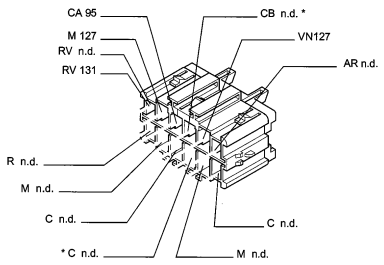

P4F882N01

**Engine cooling (1910 JTD)**

Key to components

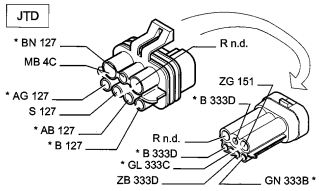
3 Power fuse box
8 Left front earth
10 Battery earth on engine
11 Battery
12 Ignition switch
22 Left facia earth
55 Connection between front/engine cables
122 Engine cooling fan low speed relay
123 Engine cooling fan high speed timer
127 Connection between left front cable/cable on relay holder bracket
128 Connection between front/radiator cables
129 Engine cooling fan protective power fuse
154 Engine cooling fan
170 Engine cooling fan resistor
333 Injection control unit (JTD)
365 4 stage pressure switch
369 Engine cooling fan remote control switch

### 3A Power fuse box



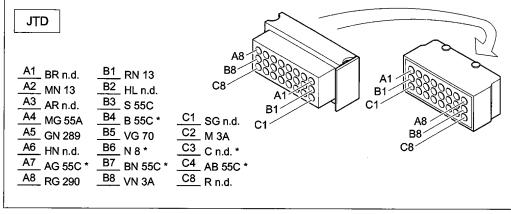

P4F882N02

### 55C Connection between front/engine cables




P4F882N03

### 127 Connection between left front cable/cable on relay holder bracket




P4F882N04

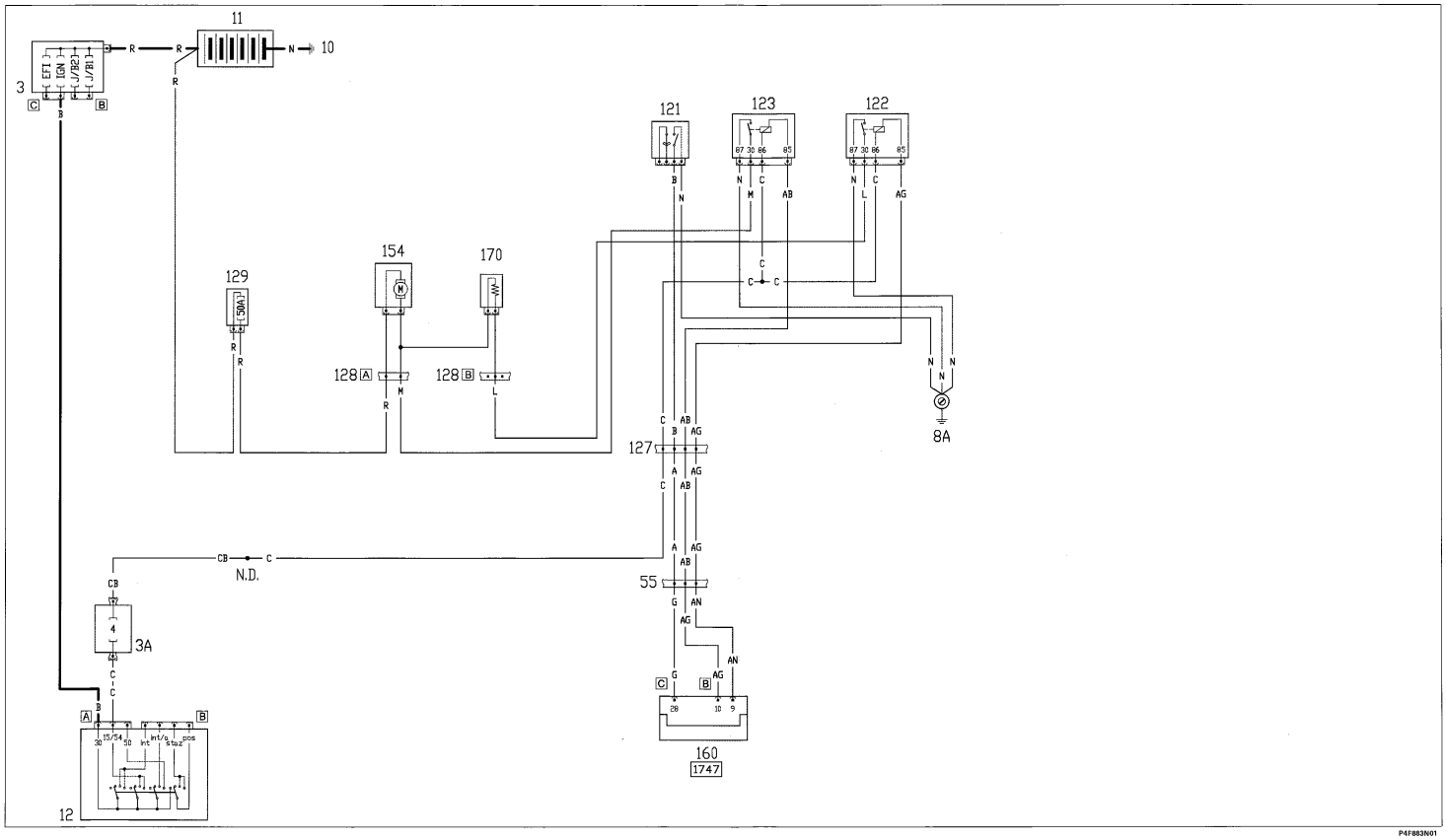
* The cables concerned are marked in the wiring diagram with an asterisk.



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# 55.

**Versions with climate control**
**Engine cooling (1747)**

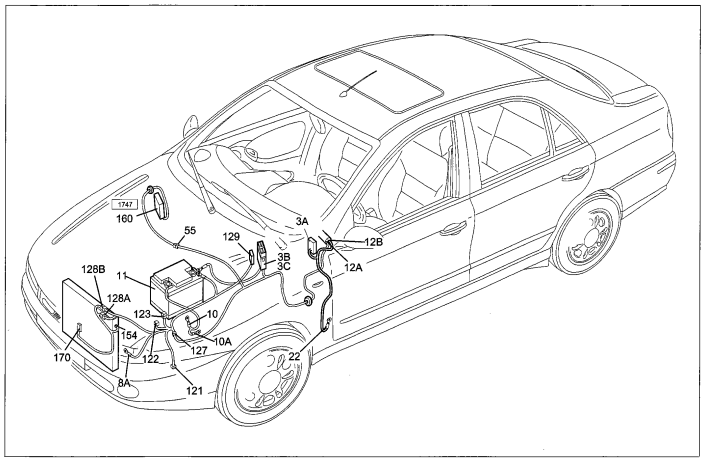



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# 55.



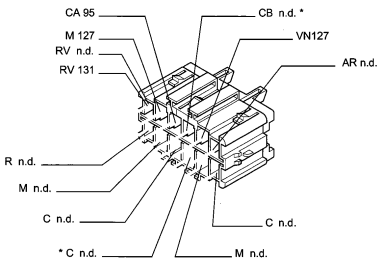

P4F884N01

**Versions with climate control**
**Engine cooling (1747)**

Key to components

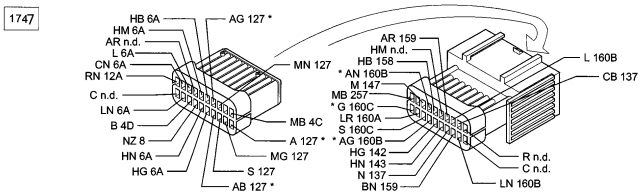
3 Power fuse box
8 Left front earth
10 Battery earth on engine
11 Battery
12 Ignition switch
55 Connection between front/engine cables
121 Three stage pressure switch
122 Engine cooling fan low speed relay
123 Engine cooling fan high speed timer
127 Connection between left front cable/cable on relay holder bracket
128 Connection between front/radiator cables
129 Engine cooling fan protective power fuse
154 Engine cooling fan
160 Injection/ignition electronic control unit (1747)
170 Resistor for engine cooling fan

## 3A Power fuse box



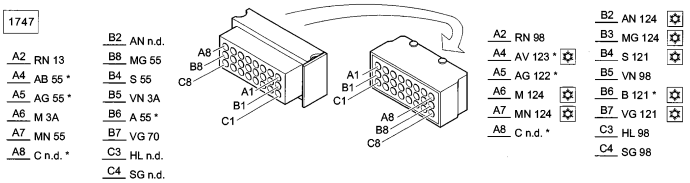

P4F884N02

## 55C Connection between front/engine cables




P4F884N03

## 127 Connection between left front cable/cable on relay holder bracket




P4F884N04

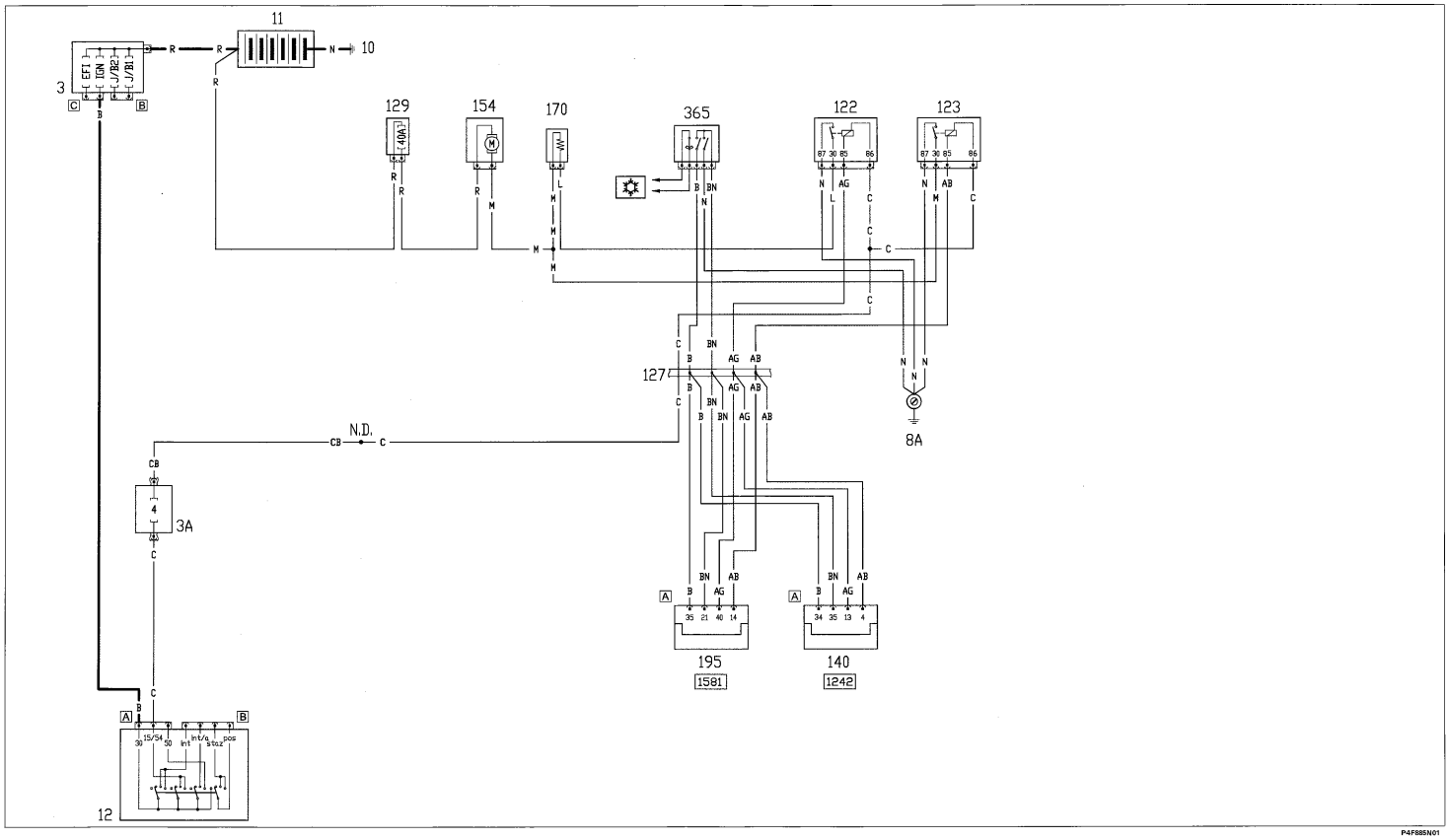
* The cables concerned are marked in the wiring diagram with an asterisk.



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## 55.

**Versions with climate control**
**Engine cooling (1242-1581)**

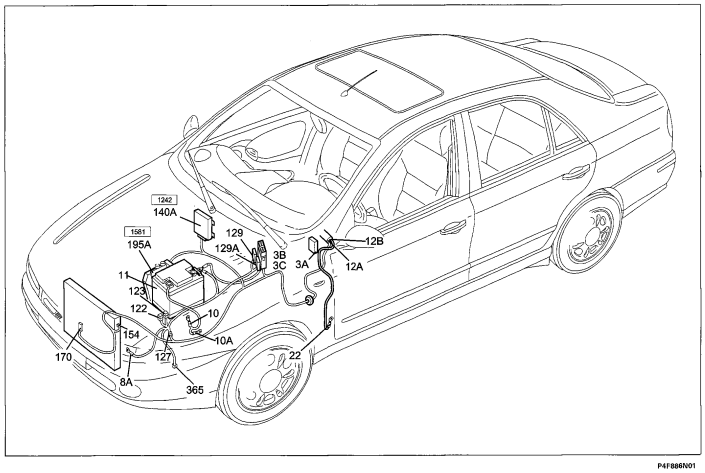



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## 55.



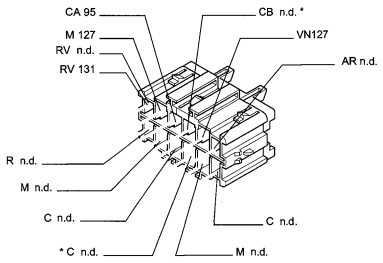

P4F886N01

**Versions with climate control**
**Engine cooling (1242-1581)**

Key to components

3 Power fuse box
8 Left front earth
10 Battery earth on engine
11 Battery
12 Ignition switch
122 Engine cooling fan low speed relay
123 Engine cooling fan high speed timer
127 Connection between left front cable/cable on relay holder bracket
129 Engine cooling fan protective power fuse
140 Injection/ignition control unit (1242)
154 Engine cooling fan
170 Resistor for engine cooling fan
195 Injection/ignition electronic control unit (1581)
365 4 stage pressure switch

### 3A Power fuse box



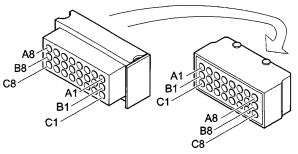

P4F886N02

### 127 Connection between left front cable/cable on relay holder bracket

1242

A2 RN 13
A4 AB 140A *
A3 AG 140A *
A6 M 3A
A7 MN 55
A8 C n.d.

B3 AR n.d.
B3 MG 140A
B4 S 140A
B5 VN 3A
B6 B 140A *
B7 VG 70
C2 BN 140A *
C3 HL n.d.
C4 SG n.d.




A2 RN 98
A4 AV 123 *
A5 AG 122 *
A6 M 124
A7 MN 124
A3 C n.d.

B2 AN 124
B3 MG 124
B4 S 365
B5 VN 98
B6 B 365 *
B7 VG 365
C2 BN 365 *
C3 HL 98
C4 SG 98

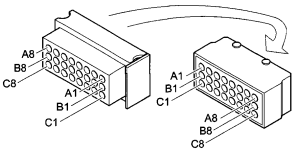
P4F886N03

### 127 Connection between left front cable/cable on relay holder bracket

1581

A2 RN 13
A4 AB 195A *
A5 AG 195A *
A6 M 3A
A7 MN 13
A3 C n.d.

B2 AN n.d.
B3 MG 195A
B4 S 195A
B5 VN 3A
B6 B 195A *
B7 VG 70
C3 BN 195A *
C3 HL n.d.
C4 SG n.d.




A2 RN 98
A4 AV 123 *
A5 AG 122 *
A6 M 124
A7 MN 124
A8 C n.d.

B2 AN 124
B3 MG 124
B4 S 365
B5 VN 98
B6 B 365 *
B7 VG 365
C2 BN 365 *
C3 HL 98
C4 SG 98

P4F886N04

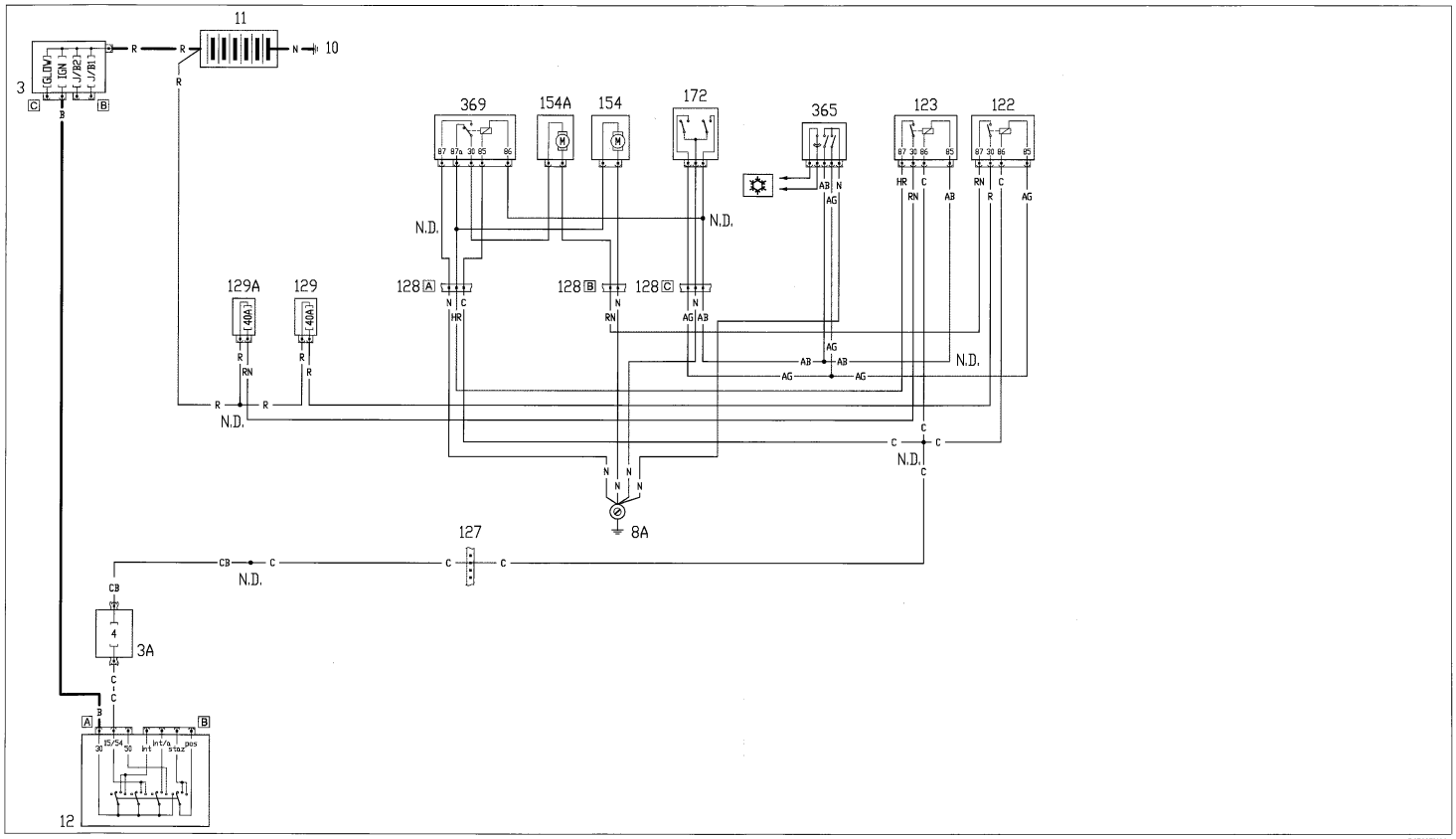
* The cables concerned are marked in the wiring diagram with an asterisk.



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## 55.

**Engine cooling (1910-75)**

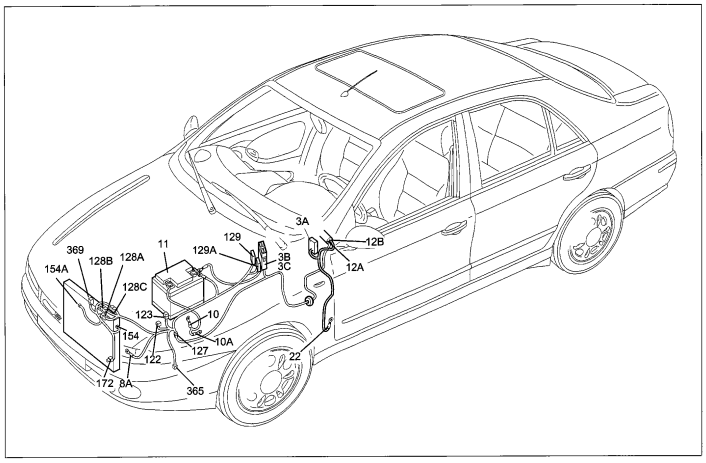



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# 55.



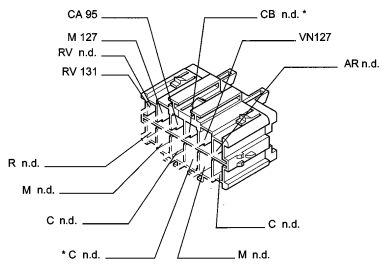

P4F888N01

**Engine cooling (1910-75)**

Key to components

3 Power fuse box
8 Left front earth
10 Battery earth on engine
11 Battery
12 Ignition switch
122 Engine cooling fan low speed relay
123 Engine cooling fan high speed timer
127 Connection between left front cable/cable on relay holder bracket
128 Connection between front/radiator cables
129 Engine cooling fan protective power fuse
154 Engine cooling fan
172 Two stage thermal switch
365 4 stage pressure switch
369 Engine cooling fan remote control switch

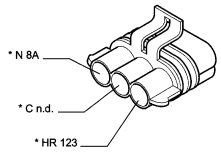
**3A** Power fuse box




P4F888N02

**128A** Connection between front/radiator cables

1910-75



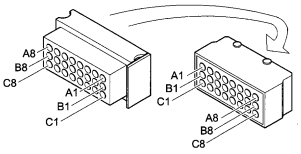

P4F888N03

**127** Connection between left front cable/cable on relay holder bracket

1910-75

A2 MN 55
A4 MG 233
B1 RN 13
B2 HL n.d.
B3 S 233
B5 VG 70
B8 VN 3A

C1 SG n.d.
C2 L 3A
C3 C n.d. *
C5 V 55
C6 MB 4C
C7 G 55




A2 MN 305
A4 MG 124
B1 RN 98
B2 HL 98
B3 S 365
B5 VG 365
B3 VN 98

C1 SG 98
C2 M 124
C3 C n.d. *
C5 V 370
C6 MB 370
C7 MG 305

P4F888N04

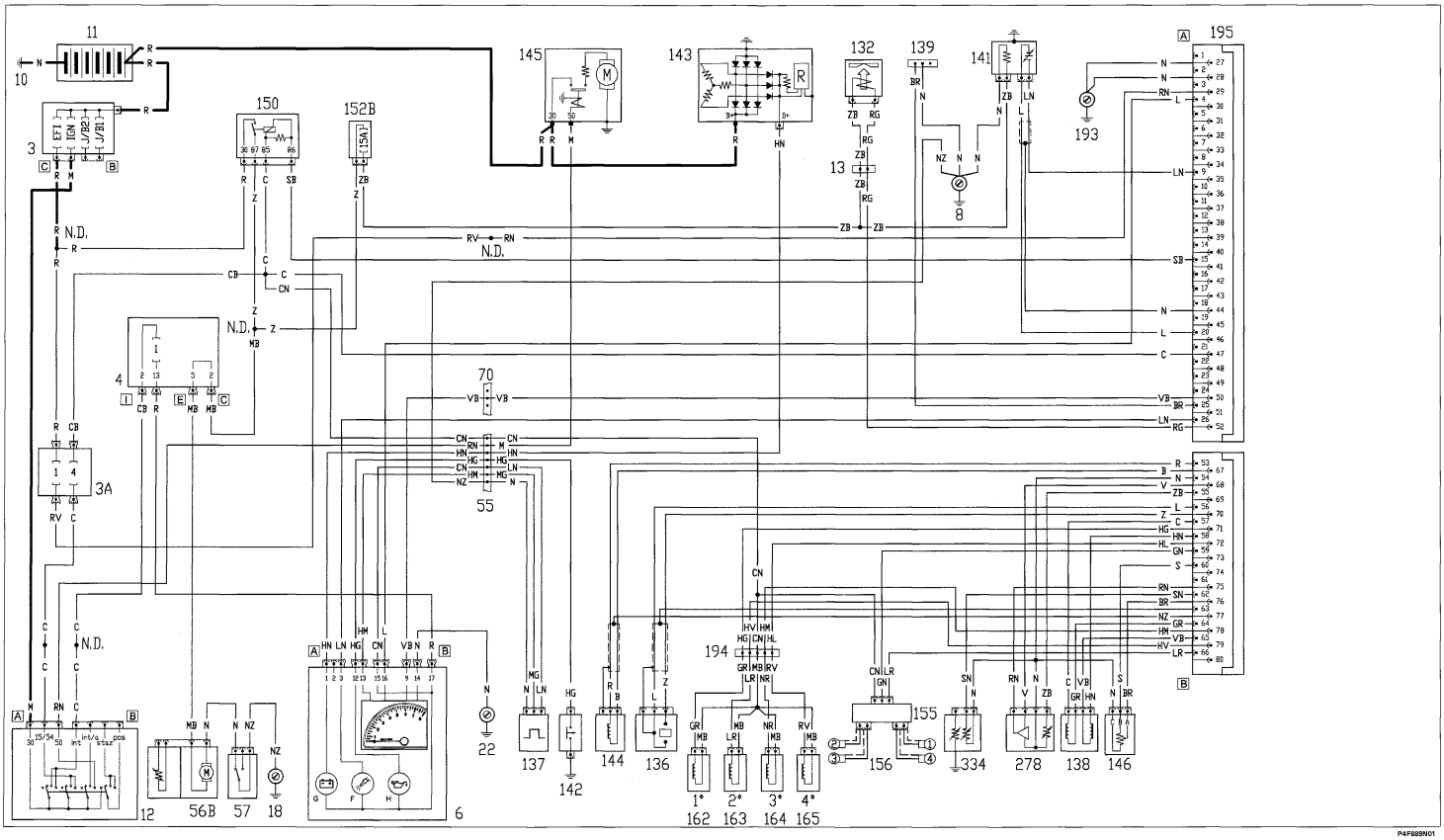
* The cables concerned are marked in the wiring diagram with an asterisk.



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## 55.

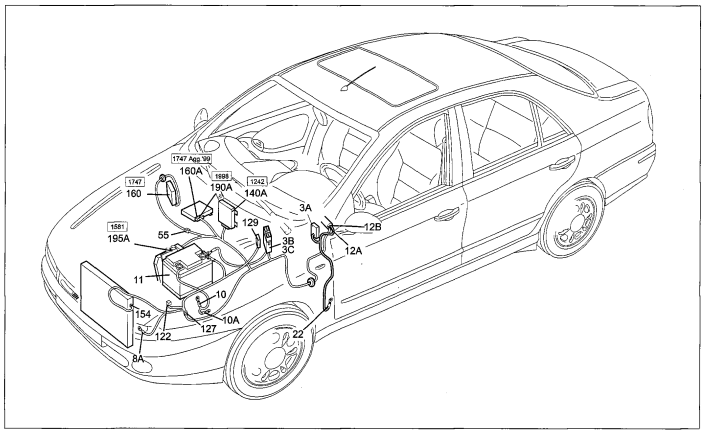
**Versions without climate control**
**Engine cooling (petrol engine)**






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## 55.




P4F890N01

**Versions without climate control**
**Engine cooling - ( petrol engine)**

Key to components

3 Direction indicator
8 Left front earth
10 Battery earth on engine
11 Battery
12 Ignition switch
55 Connection between front/engine cables
122 Engine cooling fan low speed relay
127 Connection between left front cable/cable on relay holder bracket
129 Engine cooling fan protective power fuse
140 Injection/ignition control unit (1242)
154 Engine cooling fan
160 Injection/ignition electronic control unit (1747)
190 Injection/ignition electronic control unit (1998)
195 Injection/ignition electronic control unit (1581)

### 127 Connection between left front cable/cable on relay holder bracket

1998

| | | | | | |
|---|---|---|---|---|---|
| A1 R n.d. | B1 MB 4C | A1 R n.d. | B4 S 365 | C5 HR n.d. | |
| A2 RN 13 | B2 AN n.d. | A2 RN 98 | B5 VN 98 | C6 AR n.d. | |
| A3 BG 190A | B3 MG 190A | A3 BV 151 | B6 B 365 | C7 G 190A | |
| A4 AB 190A | B4 S 190A | A4 AB 123 | B7 VG 365 | | |
| A6 AG 190A * | B5 VN 3A | A5 AG 122 * | C2 BN 365 | | |
| A6 M 3A | B6 B 190A | A6 M 124 | C3 HL 98 | | |
| A7 MN 55 | B7 VG 70 | A7 MN 124 | C4 SG 98 | | |
| A8 C n.d. * | C2 BN190A | A8 C n.d. * | C5 HR 152A | | |
| | C3 HL n.d. | B1 MB 151 | C6 AR 152B | | |
| | C4 SG n.d. | B2 AN 124 | C7 G 150 | | |
| | | B3 MG 124 | | | |

P4F890N03

### 127 Connection between left front cable/cable on relay holder bracket

1747 agg.99

| | | | | | |
|---|---|---|---|---|---|
| A1 R n.d. | B3 MG 160A | A1 R n.d. | B4 S 365 | C7 GL 160A | |
| A2 RN 13 | B4 S 160A | A2 RN 98 | B5 VN 98 | C8 RG 55A | |
| A3 BG 160A | B5 VN 3A | A3 BG151 | B6 B 365 | | |
| A4 AB 160A | B6 B 160A | A4 AV 123 | B7 VG 365 | | |
| A5 AG 160A * | B7 VG 70 | A5 AG 122 * | B8 BR 152B | | |
| A6 M 3A | B8 BR n.d. | A6 M 124 | C2 BN 365 | | |
| A7 MN 13 | C2 BN 160A | A7 MN 124 | C3 HL 98 | | |
| A8 C n.d. * | C3 HL n.d. | A8 C n.d. * | C4 SG 98 | | |
| B1 MB 4C | C4 SG n.d. | B1 MB 151 | C5 HR 152A | | |
| B2 AN n.d. | C5 HR n.d. | B2 AN 124 | C7 GL 368 | | |
| | C6 N 160A | B3 MG 124 | C8 RG n.d. | | |

P4F890N03

### 127 Connection between left front cable/cable on relay holder bracket

1581

| | | | | |
|---|---|---|---|---|
| A2 RN 13 | B2 AN n.d. | A2 RN 98 | B2 AN 124 | |
| A4 AB 195A | B3 MG 195A | A4 AV 123 | B3 MG 124 | |
| A5 AG 195A * | B4 S 195A | A5 AG 122 * | B4 S 365 | |
| A6 M 3A | B5 VN 3A | A6 M 124 | B5 VN 98 | |
| A7 MN 13 | B6 B 195A | A7 MN 124 | B6 B 365 | |
| A5 C n.d. * | B7 VG 70 | A8 C n.d. * | B7 VG 365 | |
| | C2 BN 195A | | C2 BN 365 | |
| | C3 HL n.d. | | C3 HL 98 | |
| | C4 SG n.d. | | C4 SG 98 | |

P4F890N04

### 127 Connection between left front cable/cable on relay holder bracket

1242

| | | | | |
|---|---|---|---|---|
| A2 RN 13 | B2 AR n.d. | A2 RN 98 | B2 AN 124 | |
| A4 AB 140A | B3 MG 140A | A4 AV 123 | B3 MG 124 | |
| A5 AG 140A * | B4 S 140A | A5 AG 122 * | B4 S 365 | |
| A6 M 3A | B5 VN 3A | A6 M 124 | B5 VN 98 | |
| A7 MN 55 | B6 B 140A | A7 MN 124 | B6 B 365 | |
| A8 C n.d. * | B7 VG 70 | A8 C n.d. * | B7 VG 365 | |
| | C2 BN 140A | | C2 BN 365 | |
| | C3 HL n.d. | | C3 HL 98 | |
| | C4 SG n.d. | | C4 SG 98 | |

P4F890N05

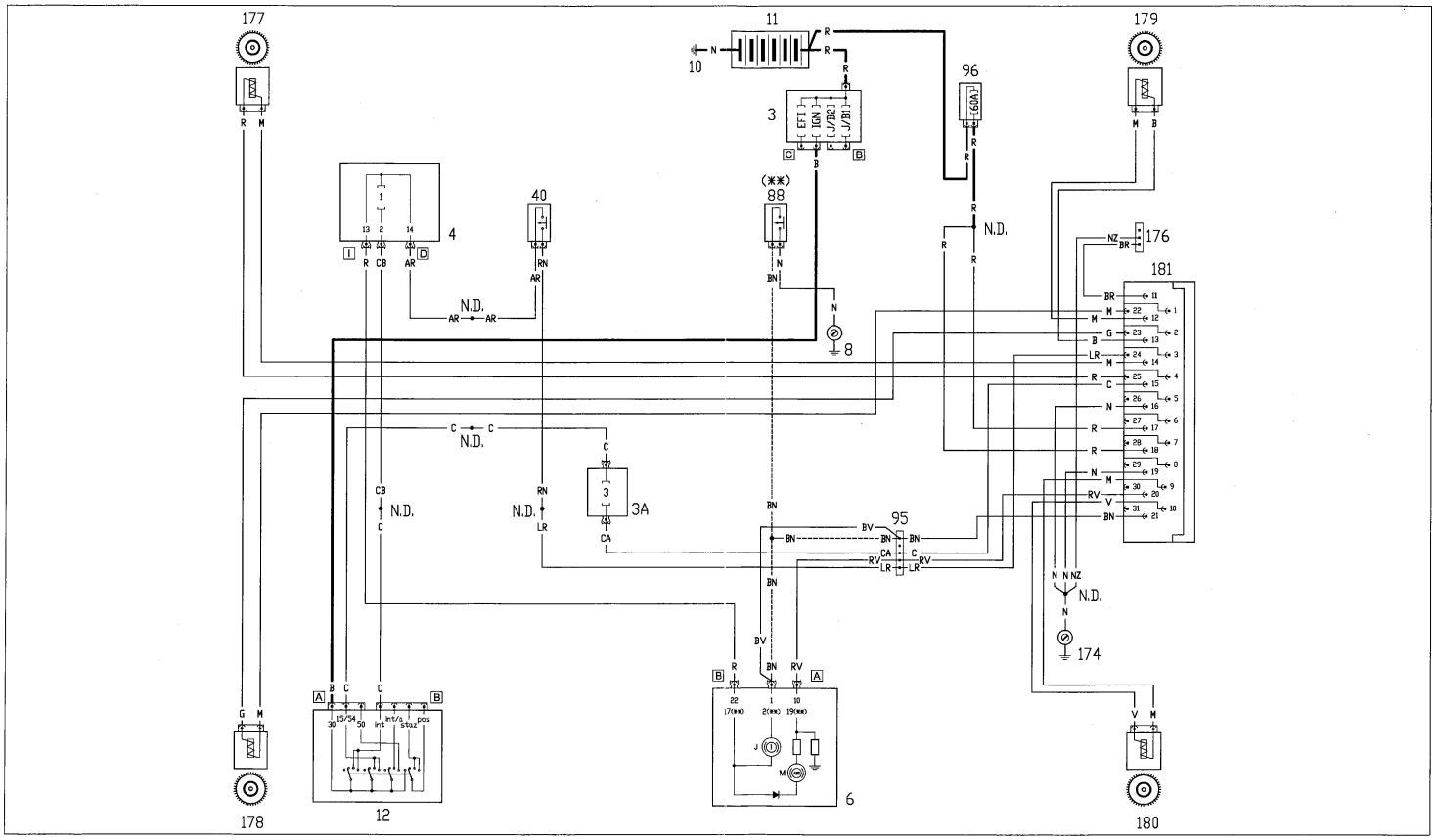
* The cables concerned are marked in the wiring diagram with an asterisk.



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## 55.

**Anti-locking braking system (ABS) and failure warning light**

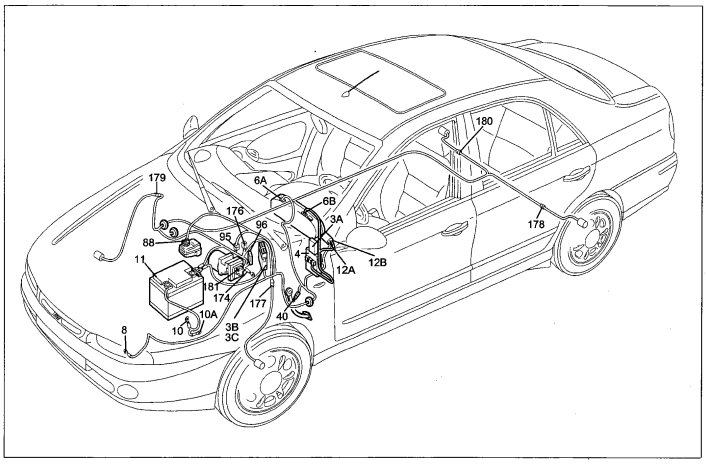



** Variants up to Nov. '99



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## 55.



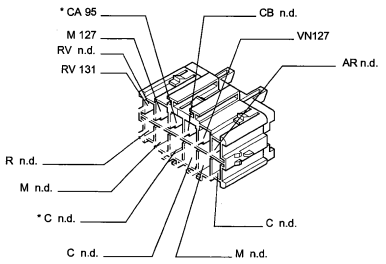

P4F892N01

**Anti-locking braking system (ABS) and failure warning light**

Component key

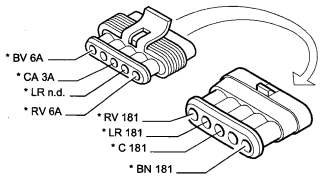
3 Power fusebox
4 Junction unit
6 Instrument panel
8 Left front earth
10 Engine battery earth
11 Battery
12 Ignition switch
40 Brake lights control switch
88 Insufficient brake fluid level sensor
95 Connection between front cables/anti-lock brakes A.B.S.
96 60A fuse protecting anti-lock brakes (A.B.S.)
174 Power earth for A.B.S.
176 Tester point for A. B. S.
177 Sensor on left front wheel (A.B.S.)
178 Sensor on left rear wheel (A.B.S.)
179 Sensor on right front wheel (A.B.S.)
180 Sensor on right rear wheel (A.B.S.)
181 Electro-hydraulic control unit

**3A** Power fusebox




P4F892N02

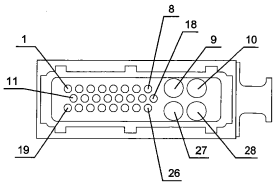
**95** Connection between front cables/anti-lock brakes A.B.S. leads




P4F892N06

**181** A.B.S. hydraulic control unit

| | | | |
|---|---|---|---|
| 9 | M 180 * | 18 | R n.d. * |
| 10 | V 180 * | 19 | N n.d. * |
| 11 | BR 176 * | 20 | RV 95 * |
| 12 | M 179 * | 21 | BN 95 * |
| 13 | B 179 * | 22 | M 178 * |
| 14 | M 177 * | 23 | G 178 * |
| 15 | C 95 * | 24 | LR 95 * |
| 16 | N n.d. * | 25 | R 177 * |
| 17 | R n.d. * | | |




P4F892N04

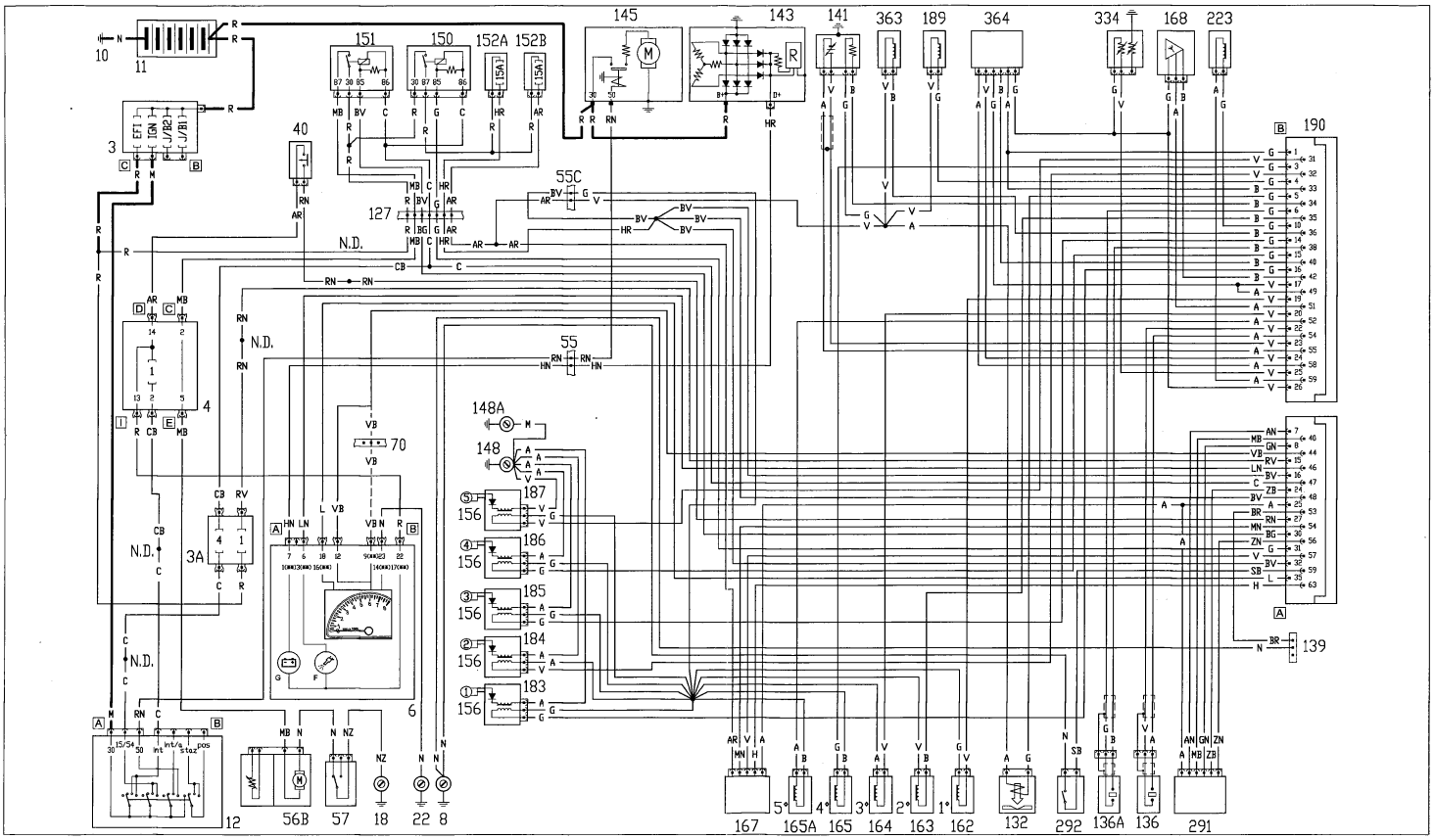
(*) The cables involved in the wiring diagram are marked with an asterisk.



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## 55.

**Starting - Electronic ignition and injection - Recharging and warning light - Insufficient engine oil pressure warning light - Injection system failure warning ilight - Rev counter (1998)**

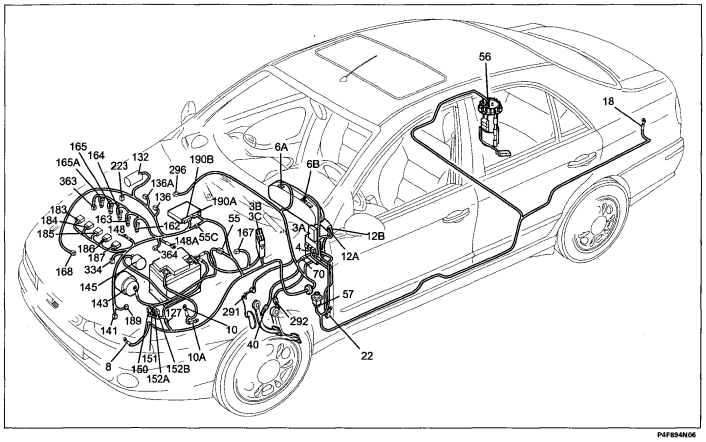



** Variants up to Nov. '99



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## 55.




P4F894N06

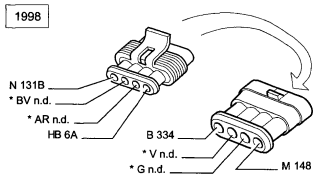
**Starting - Electronic ignition and injection - Recharging and warning light - Insufficient engine oil pressure warning light - Injection system failure warning ilight - Rev counter (1998)**

Component key

3 Power fusebox
4 Junction unit
6 Instrument panel
8 Left front earth
10 Engine battery earth
12 Ignition switch
18 Left rear earth
22 Left facia earth
40 Brake lights control switch
55 Connection between front/engine cables
57 Inertia switch
70 Connection between dashborad/front cables
68 Right door mirror
70 Connection between dashborad/front cables
127 Connection between front left cable/cable on relay holder bracket
132 Petrol vapour cut out solenoid valve
136 Knock sensor
142 Heated Lambda sensor
143 Alternator
145 Starter motor
148 Earth for electronic injection
150 Injection system relay feed
151 Control relay for lambda probe, fuel pump and injectors
152 Fuse protecting injection system
162 Injector (1st)
163 Injector (2nd)
164 Injector (3rd)
165 Injector (4th)
167 Air flow meter (debimeter)
168 Timing sensor
184 Ignition coils (2nd)
185 Ignition coils (3rd)
186 Ignition coils (4th)
187 Ignition coils (5th) (1998)
189 Variable valve timing
223 Rpm sensors
291 Potentiometer on accelerator pedal
292 Clutch pedal switch
296 Throttle lever potentiometer
334 Dual engine temperature sending unit
363 Variable valve timing actuator (998)
364 Motorized throttle body

### 55C Front/engine lead connection

1998




P4F894N03

### 127 Connection between front left cable/cable on relay holder bracket

1998

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A1 | R n.d. * | B1 | MB 4C * | C5 | HR n.d. * | A1 | R n.d. * |
| A2 | RN 13 | B2 | AN n.d. | C6 | AR n.d. * | A2 | RN 98 |
| A3 | BG 190A * | B3 | MG 190A | C7 | G 190A * | A3 | BV 151 * |
| A4 | AB 190A | B4 | S 190A | | | A4 | AB 123 |
| A5 | AG 190A | B5 | VN 3A | | | A5 | AG 122 |
| A6 | M 3A | B6 | B 190A | | | A6 | M 124 |
| A7 | MN 55 | B7 | VG 70 | | | A7 | MN 124 |
| A8 | C n.d. * | C2 | BN190A | | | A8 | C n.d. * |
| | | C3 | HL n.d. | | | B1 | MB 151 * |
| | | C4 | SG n.d. | | | B2 | AN 124 |
| | | | | | | B3 | MG 124 |

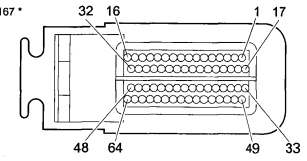
| | | | |
|---|---|---|---|
| B4 | S 365 | C2 | BN 365 |
| B5 | VN 98 | C3 | HL 98 |
| B6 | B 365 | C4 | SG 98 |
| B7 | VG 365 | C5 | HR 152A * |
| | | C6 | AR 152B * |
| | | C7 | G 150 * |

P4F894N03

### 190A Injection/ignition electronic control unit (1998)

1998

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 3 | GV 131 * | 25 | A n.d * | 46 | LN 6A * | 62 | AB 127 * |
| 6 | S 127 * | 27 | RN n.d. * | 47 | C n.d * | 63 | H 167 * |
| 7 | AN 291 * | 30 | BG 127 * | 48 | BV n.d * | | |
| 8 | GN 291 * | 31 | G 127 * | 50 | AG 127 * | | |
| 9 | B 127 * | 32 | BV n.d * | 53 | BR 139 * | | |
| 13 | MG 127 * | 35 | L 6A * | 54 | MN 167 * | | |
| 15 | RV n.d. * | 40 | HB 291 * | 56 | ZN 291 * | | |
| 16 | BV n.d * | 41 | BN 127 * | 57 | V 167 *. | | |
| 24 | ZB 291 * | 44 | VB 70 * | 59 | SB 292 * | | |

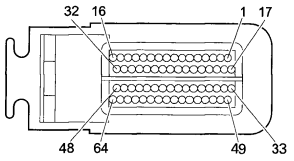



P4F894N04

### 190B Injection/ignition electronic control unit (1998)

1998

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | G n.d. * | 18 | V 162 * | 34 | B n.d. * | 55 | A 141 * |
| 3 | G 165 * | 20 | V 164 * | 35 | B 163 * | 58 | A 364 * |
| 4 | G 189 * | 22 | V 136 * | 36 | B 363 * | 59 | A 223 * |
| 5 | G 132 * | 23 | V 141 * | 38 | B 136A * | | |
| 6 | G 136A * | 24 | V 64 * | 40 | B 364 * | | |
| 10 | G 223 * | 25 | V 334 * | 42 | B 168 * | | |
| 14 | G 185 * | 26 | V n.d. * | 49 | A n.d. * | | |
| 15 | G 186 * | 31 | V 187 * | 51 | A 168 * | | |
| 16 | G 183 * | 32 | V 184 * | 52 | A 165A * | | |
| 17 | V n.d. * | 33 | B n.d. * | 54 | A 136 * | | |




P4F894N05

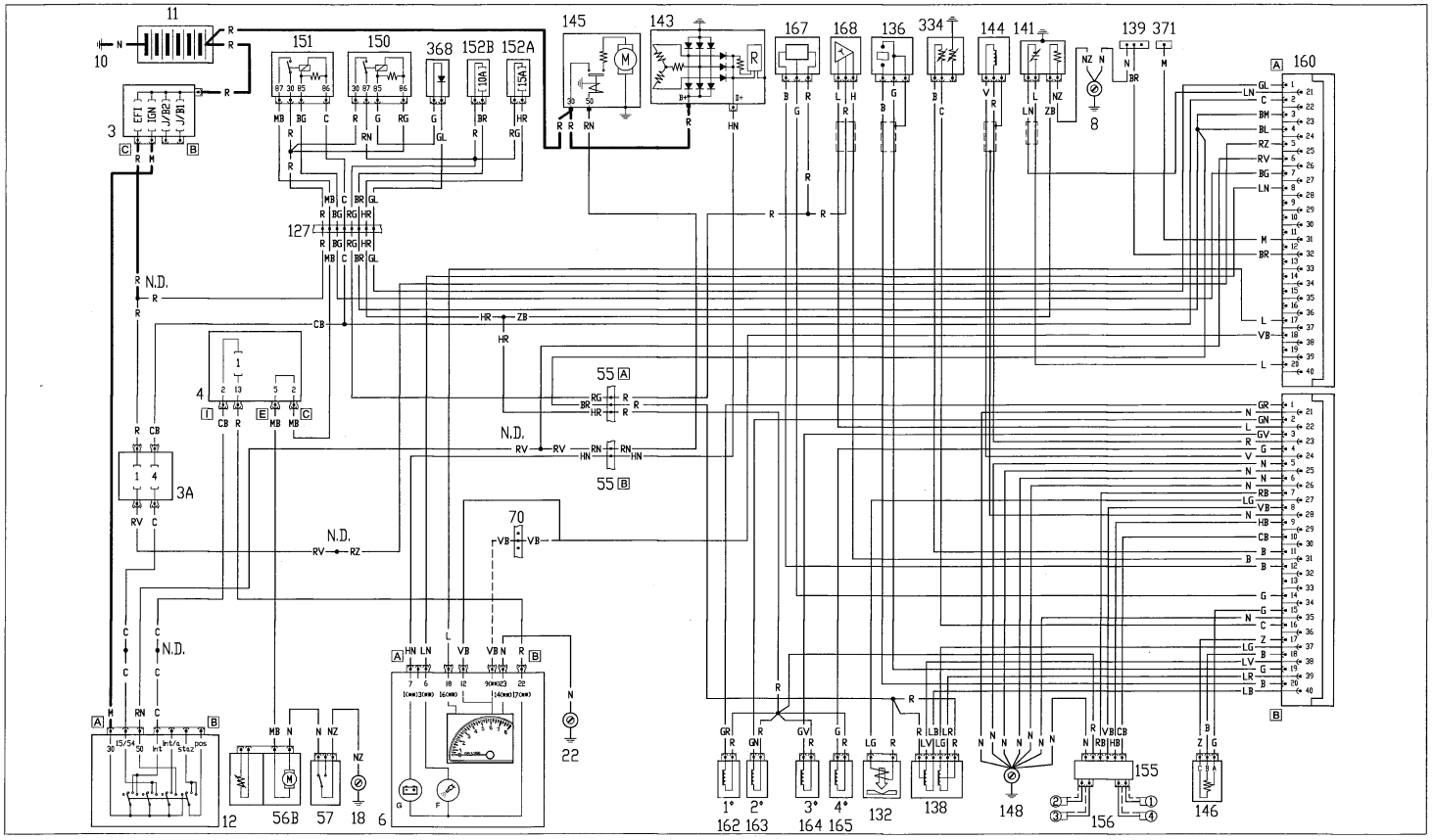
(*) The cables involved in the wiring diagram are marked with an asterisk.



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## 55.

**Starting - Electronic ignition and injection - Recharging and warning light - Insufficient engine oil pressure warning light - Injection system failure warning ilight - Rev counter (1747 '99 update)**

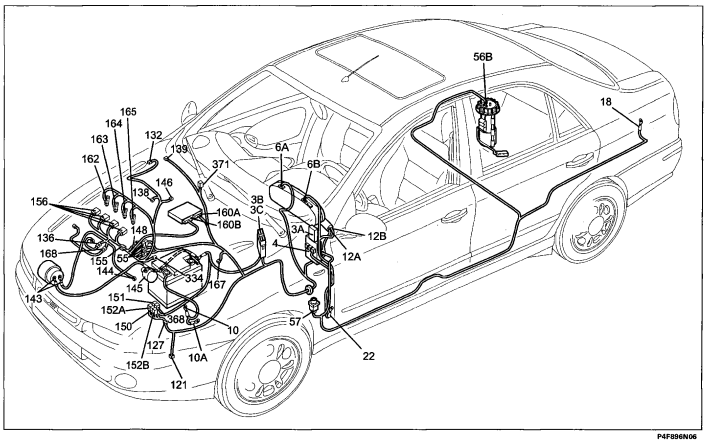



** Variants up to Nov. '99



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## 55.




P4F896N06

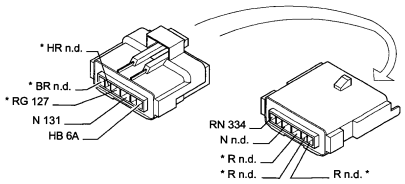
**Starting - Electronic ignition and injection - Recharging and warning light - Insufficient engine oil pressure warning light - Injection system failure warning light - Rev counter (1747 '99 update)**

Component key

3 Power fusebox
4 Junction unit
6 Instrument panel
10 Engine battery earth
12 Ignition switch
18 Left rear earth
22 Left facia earth
55 Front/engine lead connection
56 Fuel level gauge control unit
57 Inertia switch
121 Three-stage pressure switch
127 Connection between front left cable/cable on relay holder bracket
132 Petrol vapour cut out solenoid valve
136 Knock sensor
138 Idle adjustment actuator
139 Diagnostic socket for fuel injection
143 Alternator
144 Rpm and TDC sensor
145 Starter motor
146 Potentiometer on throttle valve
148 Earth for electronic injection
150 Injection system relay feed
151 Control relay for lambda probe, fuel pump and injectors
152 Fuse protecting injection system
155 Ignition coil unit
156 Spark plugs
160 Ignition / injection electronic control unit (1747)
162 Injector (1st)
163 Injector (2nd)
164 Injector (3rd)
165 Injector (4th)
167 Air flow meter (debimeter)
168 Timing sensor
334 Dual engine temperature sending unit
368 Relay diode for injection system control
371 Tester connection

### 55A Front/engine lead connection

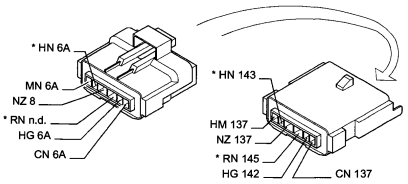
1747 agg.'99




P4F896N03

### 55B Front/engine lead connection

1747 agg.'99

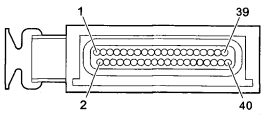



P4F896N07

### 160A Injection/ignition electronic control unit (1747)

1747 agg.'99

| | | | |
|---|---|---|---|
| 1 GL 127 * | 9 S 127 | 26 N 127 | |
| 2 C n.d. * | 10 MG 127 | 27 B 127 | |
| 3 BM n.d. * | 14 AG 127 | 28 BN 127 | |
| 4 BL n.d. * | 15 AV 127 | 30 GV 131 | |
| 5 RZ n.d. * | 17 L 6A * | 31 M 371 * | |
| 6 RV n.d. * | 18 VB 70 * | 32 BR 139 * | |
| 7 BG 127 * | 20 L 141 * | | |
| 8 LN 6A | 21 LN 141 * | | |

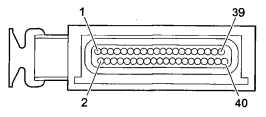



P4F896N04

### 160B Injection/ignition electronic control unit (1747)

1747 agg.'99

| | | | |
|---|---|---|---|
| 1 GR 162 * | 10 CB 155 * | 20 B n.d. * | 31 B n.d. * |
| 2 GN 163 * | 11 B 334 * | 21 N n.d. * | 35 N n.d. * |
| 3 GV 164 * | 12 B n.d. * | 22 L 168 * | 37 LG 138 * |
| 4 G 165 * | 14 G 167 * | 23 R 144 * | 38 LV 138 * |
| 5 N n.d. * | 15 G 146 * | 24 V 144 * | 39 LR 138 * |
| 6 N n.d. * | 16 C 334 * | 25 N n.d. * | 40 LB 138 * |
| 7 RB 155 * | 17 Z 146 * | 26 N n.d. * | |
| 8 VB 155 * | 18 B n.d. * | 27 LG 132 * | |
| 9 HB 155 * | 19 G 136 * | 28 N n.d. * | |




P4F896N05

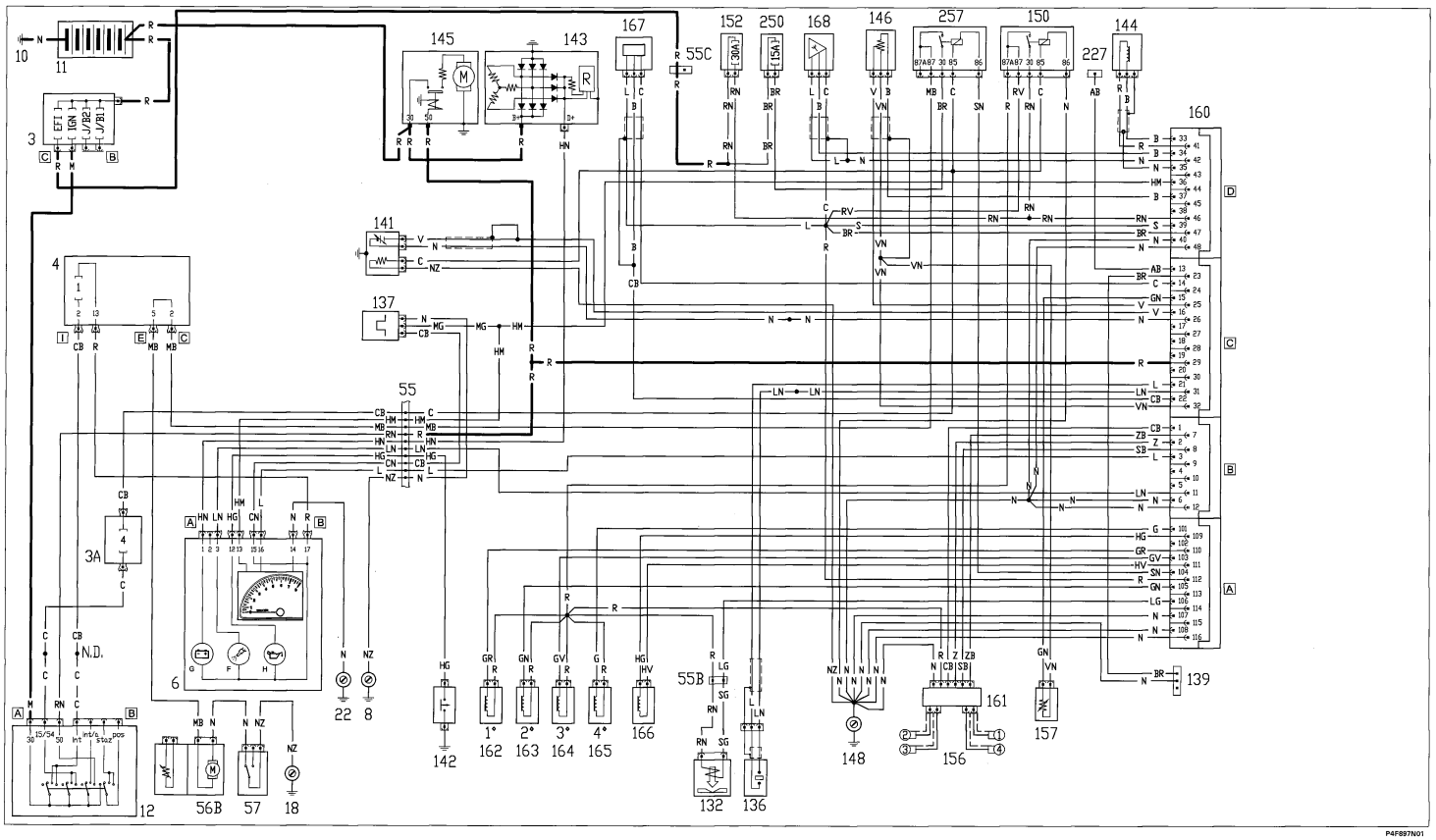
(*) The cables involved in the wiring diagram are marked with an asterisk.



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## 55.

**Starting - Electronic ignition and injection - Recharging and warning light - Insufficient engine oil pressure warning light - Injection system failure warning light - Rev counter (1747)**



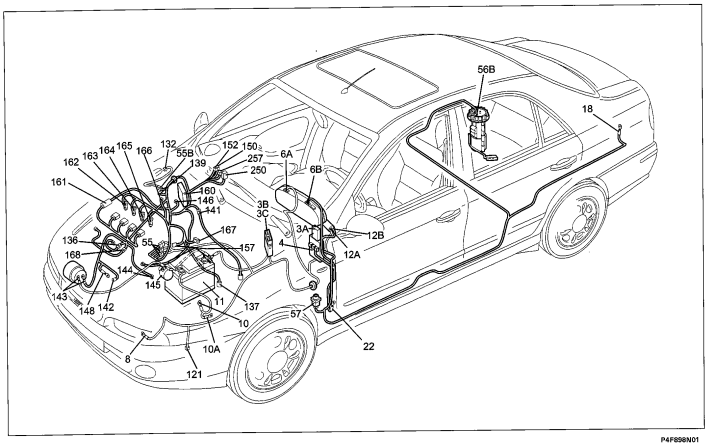

P4F897N01

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# 55.



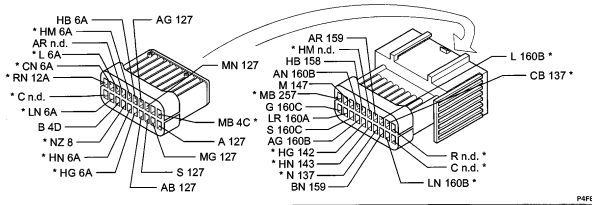

**Starting - Electronic ignition and injection - Recharging and warning light - Insufficient engine oil pressure warning light - Injection system failure warning light - Rev counter (1747)**

Key to components

3 Direction indicator
4 Junction unit
6 Instrument panel
8 Left front earth
10 Battery earth on engine
11 Battery
12 Ignition switch
18 Left rear earth
22 Left facia earth
55 Connection between front/engine cables
56 Fuel gauge assembly
57 Inertia switch
121 Three stage pressure switch
132 Petrol vapour cut out solenoid valve
136 Detonation sensor
137 Vehicle speed sensor
139 Diagnostic sockect for injection system
141 Heated Lambda sensor
142 Switch signalling insufficient engine oil pressure
143 Alternator
144 RPM and TDC sensor
145 Starter motor
146 Potentiometer on butterfly valve
150 Injection system relay feed
152 Injection system protective fuse
157 Water temperature sensor for injection system
160 Injection/ignition electronic control unit (1747)
161 Ignition power module
162 Injector (1)
163 Injector (2)
164 Injector (3)
165 Injector (4)
166 Idle adjustment actuator
167 Air flow meter
168 Timing sensor
250 Fuel pump protective fuse
257 Fuel pump relay feed

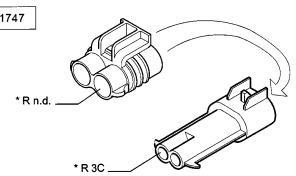
**55** Connection between front/engine cables

1747



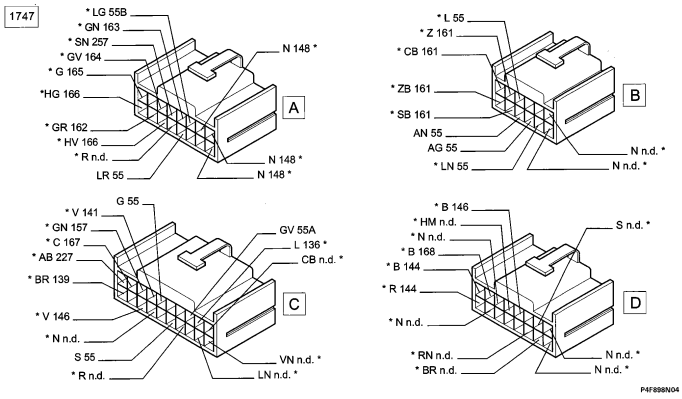

**55C** Connection between front/engine cables

1747




**160** Injection/ignition electronic control unit (1747)

1747



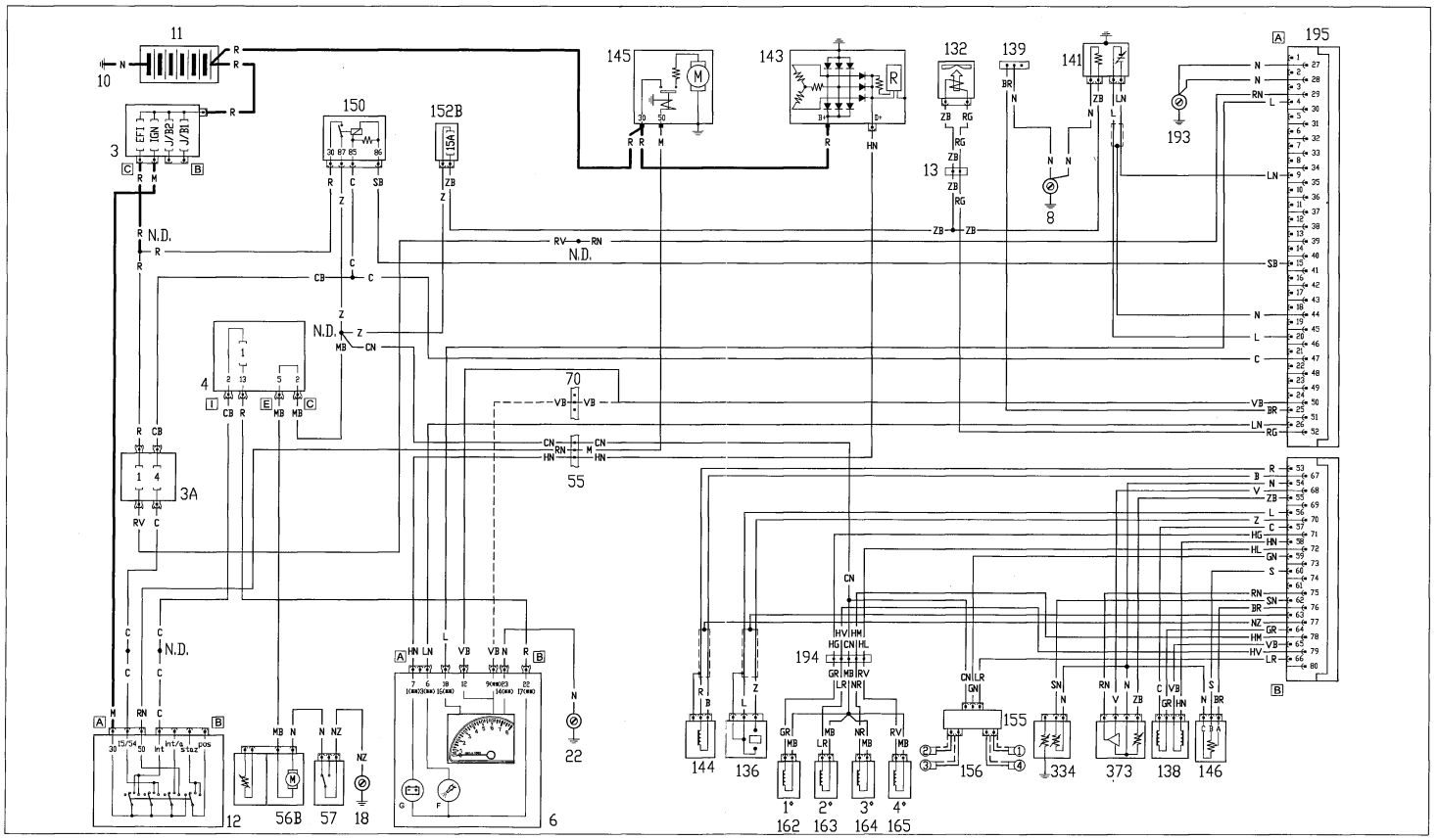

* The cables concerned are marked in the wiring diagram with an asterisk.



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## 55.

**Starting - Electronic ignition and injection - Recharging and warning light - Insufficient engine oil pressure warning light - Injection system failure warning light - Rev counter (1581)**

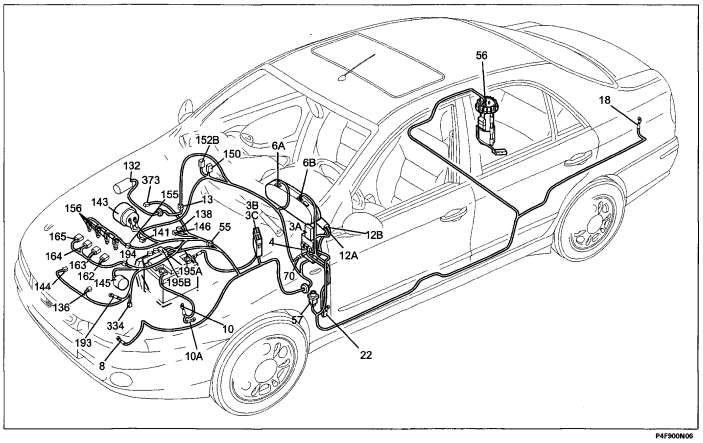



** Variants up to Nov. '99



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## 55.




P4F900N06

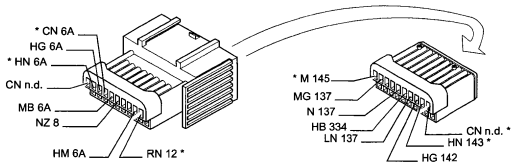
**Starting - Electronic ignition and injection - Recharging and warning light - Insufficient engine oil pressure warning light - Injection system failure warning light - Rev counter (1581)**

Component key

3 Power fusebox
4 Junction unit
6 Instrument panel
8 Left front earth
10 Engine battery earth
12 Ignition switch
13 Connection between right/left front cables
18 Left rear earth
22 Left facia earth
55 Front/engine lead connection
56 Fuel level gauge control unit
57 Inertia switch
70 Connection between dashborad/front cables
132 Petrol vapour cut out solenoid valve
136 Knock sensor
138 Idle adjustment actuator
142 Heated Lambda sensor
143 Alternator
144 Rpm and TDC sensor
145 Starter motor
146 Potentiometer on throttle valve
150 Injection system relay feed
152 Fuse protecting injection system
155 Ignition coil unit
156 Spark plugs
162 Injector (1st)
163 Injector (2nd)
164 Injector (3rd)
165 Injector (4th)
193 Earth for electronic injection
194 Injection lead/injector braid connection
195 Ignition / injection control unit. (1581)
334 Dual engine temperature sending unit
373 Air pressure and temperature sensor

### 55 Front/engine lead connection

1581

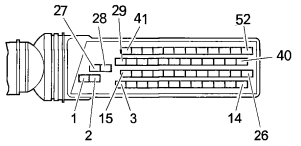



P4F900N07

### 195A Ignition / injection control unit. (1581)

1581

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4 | L 6A * | 26 | LN 6A * | 48 | S 127 | | |
| 5 | V 252 | 27 | N 193 * | 49 | NZ 252 | | |
| 9 | LN 141 * | 28 | N 193 * | 50 | VB 70 * | | |
| 13 | GV 131 | 29 | RN n.d. * | 52 | RG 13 * | | |
| 14 | AB 127 | 35 | B 127 | | | | |
| 15 | SB 150 * | 36 | LR 252 | | | | |
| 16 | GN 252 | 40 | AG 127 | | | | |
| 20 | L 141 * | 41 | MG 127 | | | | |
| 21 | BN 127 | 44 | sch 141 * | | | | |
| 25 | BR 139 * | 47 | C n.d. * | | | | |

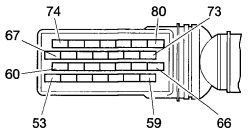



P4F900N04

### 195B Ignition / injection control unit. (1581)

1581

| | | | | | |
|---|---|---|---|---|---|
| 53 | R 144 * | 65 | VB 138 * | 77 | NZ n.d. * |
| 54 | N n.d. * | 66 | LR 155 * | 78 | HM 194 * |
| 55 | ZB 278 * | 67 | B 144 * | 79 | HV 194 * |
| 56 | L 136 * | 68 | V 278 * | | |
| 58 | HN 138 * | 70 | Z 136 * | | |
| 59 | GN 155 * | 71 | HG 194 * | | |
| 60 | S 146 * | 72 | HL 194 * | | |
| 62 | SN 339 * | 75 | RN 278 * | | |
| 64 | GR 138 * | 76 | BR 146 * | | |




P4F900N05

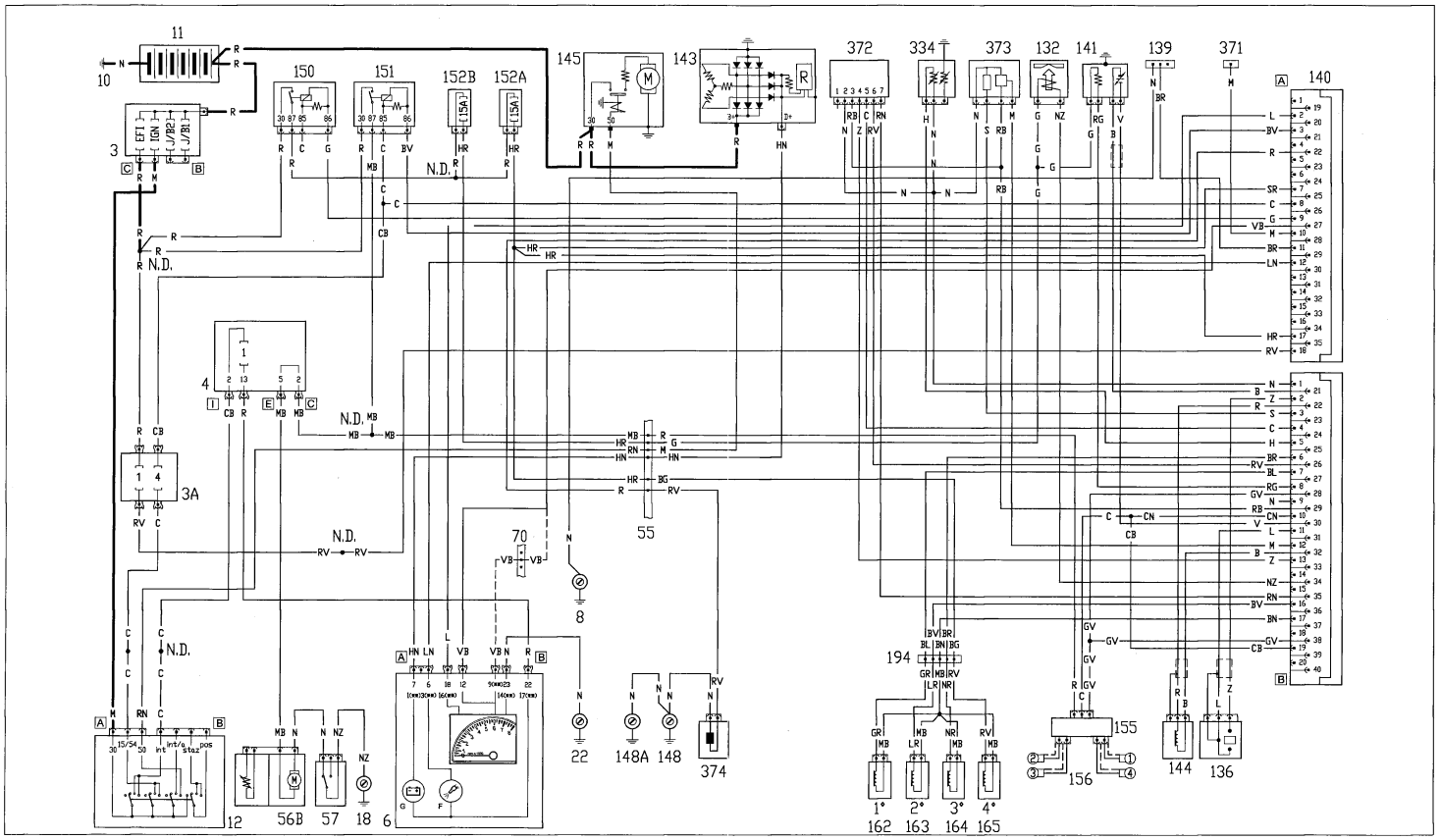
(*) The cables involved in the wiring diagram are marked with an asterisk.



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## 55.

**Starting - Electronic ignition and injection - Recharging and warning light - Insufficient engine oil pressure warning light - Injection system failure warning light - Rev counter (1242)**

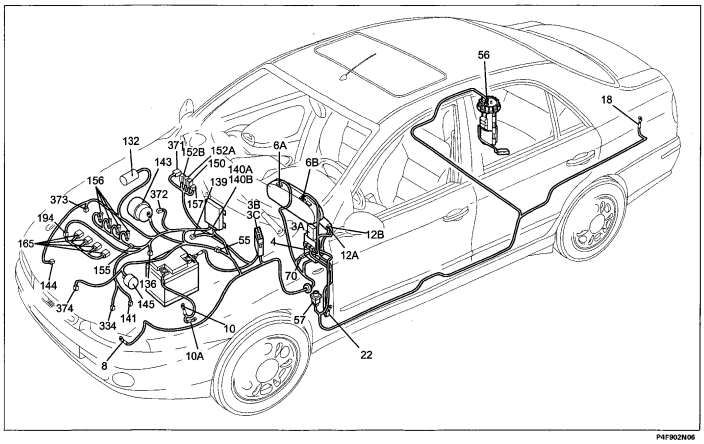



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## 55.




P4F902N06

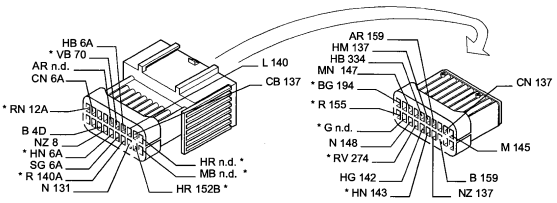
**Starting - Electronic ignition and injection - Recharging and warning light - Insufficient engine oil pressure warning light - Injection system failure warning light - Rev counter (1242)**

Component key

3 Power fusebox
4 Junction unit
6 Instrument panel
8 Left front earth
10 Engine battery earth
12 Ignition switch
18 Left rear earth
22 Left facia earth
55 Front/engine lead connection
56 Fuel level gauge control unit
57 Inertia switch
70 Connection between dashborad/front cables
132 Petrol vapour cut out solenoid valve
136 Knock sensor
139 Diagnostic socket for fuel injection
140 Injection/ignition control unit (1242)
142 Heated Lambda sensor
143 Alternator
144 Rpm and TDC sensor
145 Starter motor
146 Potentiometer on throttle valve
150 Injection system relay feed
152 Fuse protecting injection system
155 Ignition coil unit
156 Spark plugs
157 Coolant temperature sensor for injection system
165 Injector (4th)
194 Injection lead/injector braid connection
334 Dual engine temperature sending unit
371 Tester connection
372 Modular actuator
373 Air pressure and temperature sensor
374 Power steering pump sensor

### 55 Front/engine lead connection

1242

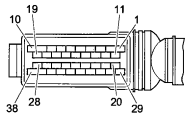



P4F902N07

### 140A Injection/ignition control unit (1242)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2 | L 6A * | 12 | LN 6A * | 31 | S 127 | | |
| 3 | BV 151 * | 13 | AG 127 | 34 | B 127 | | |
| 4 | AB 127 | 16 | GV 131 | 35 | BN 127 | | |
| 7 | SR n.d. * | 17 | HR n.d. * | | | | |
| 8 | C n.d. * | 18 | RV n.d. * | | | | |
| 9 | G 150 * | 19 | MG 127 | | | | |
| 10 | M 371 * | 22 | R 55 * | | | | |
| 11 | BR 139 * | 27 | VB 6A | | | | |

1242

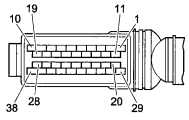



P4F902N08

### 140B Injection/ignition control unit (1242)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | N n.d. * | 9 | N n.d. * | 21 | B 141 * | 35 | RN 372 * |
| 2 | Z 136 * | 10 | CN n.d. * | 22 | R 144 * | 38 | GV n.d. * |
| 3 | S 373 * | 11 | L 136 * | 26 | RV 372 * | | |
| 4 | C 372 * | 12 | M 373 * | 28 | GV n.d. * | | |
| 5 | H 334 * | 13 | Z 372 * | 29 | RB n.d. * | | |
| 6 | BR 194 * | 16 | BV 194 * | 30 | V 141 * | | |
| 7 | BL 194 * | 17 | BN 194 * | 32 | B 144 * | | |
| 8 | RG 141 * | 19 | CB n.d. * | 34 | NZ 132 * | | |

1242




P4F902N05

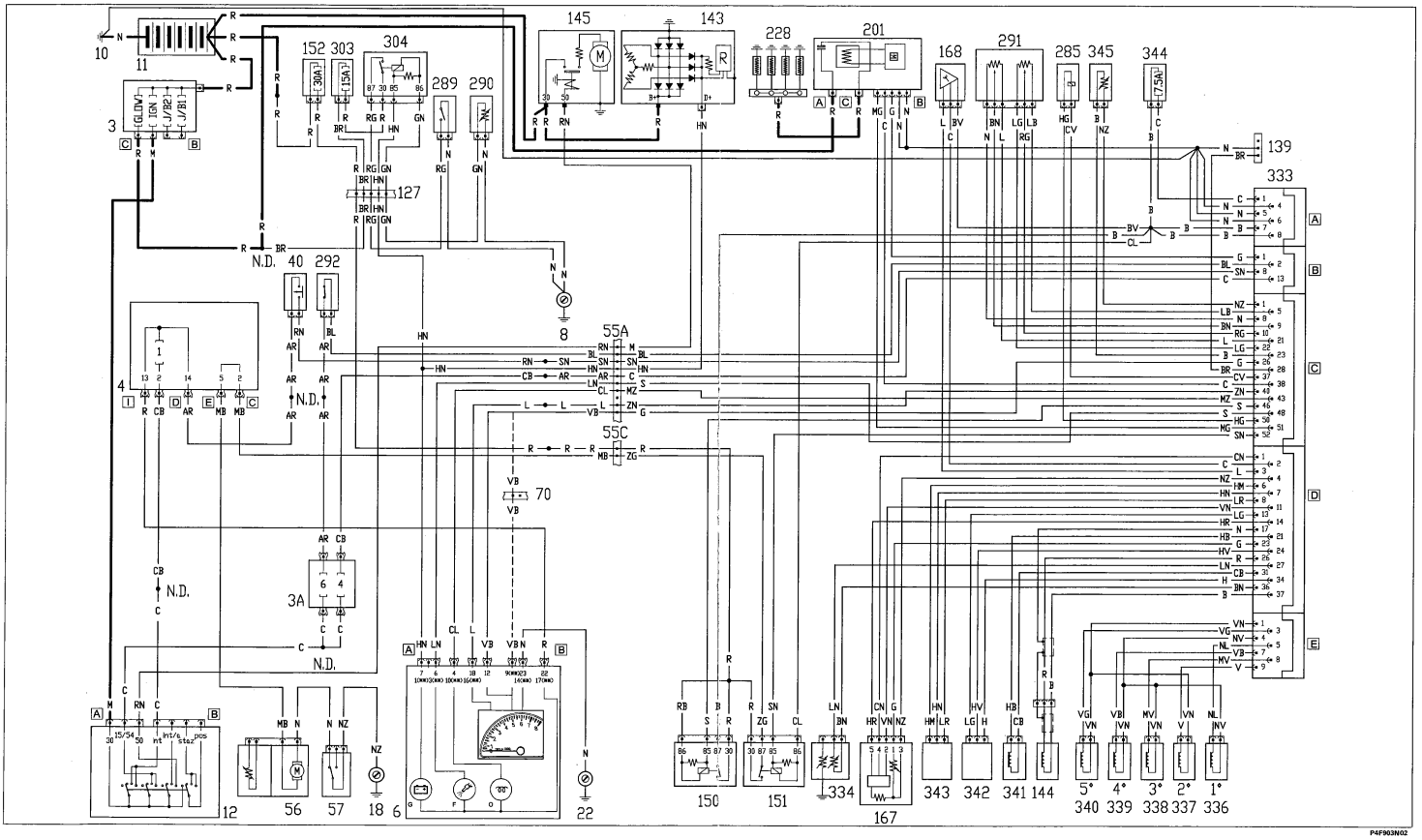
(*) The cables involved in the wiring diagram are marked with an asterisk.



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## 55.

**Starting - Electronic ignition - Recharging and warning light - Low engine oil pressure warning light - Glow plug pre-heating warning light - Injection system failure warning light - Fuel preheating (2387 JTD)**

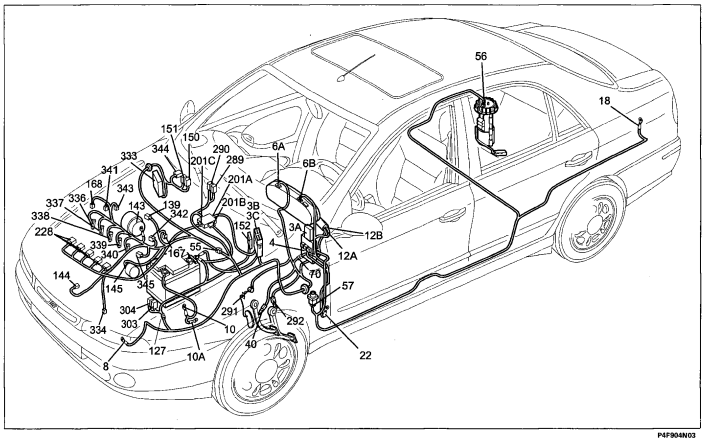



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## 55.



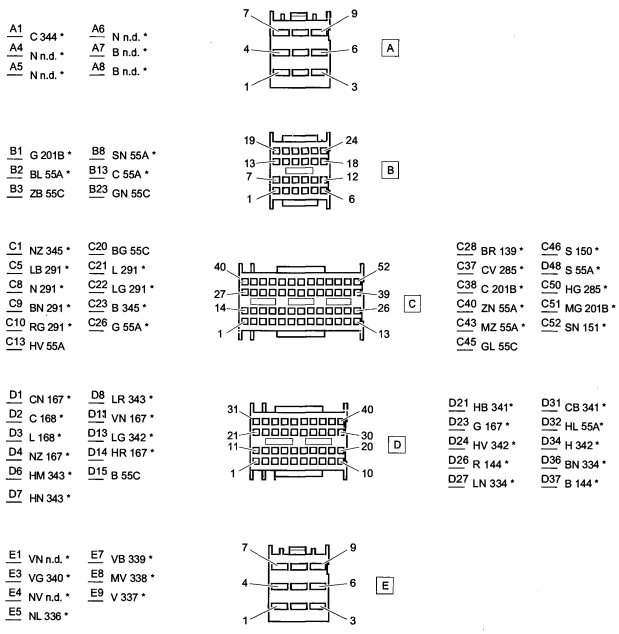

P4F904N03

**Starting - Electronic ignition - Recharging and warning light - Low engine oil pressure warning light - Glow plug preheating warning light - Injection system failure warning light - Fuel preheating (2387 JTD)**

Component key

3 Power fusebox
4 Junction unit
6 Instrument panel
8 Left front earth
10 Engine battery earth
12 Ignition switch
18 Left rear earth
22 Left facia earth
40 Brake lights control switch
55 Front/engine lead connection
56 Fuel level gauge control unit
57 Inertia switch
70 Connection between dashborad/front cables
127 Connection between front left cable/cable on relay holder bracket
139 Diagnostic socket for fuel injection
143 Alternator
144 Rpm and TDC sensor
145 Starter motor
150 Injection system relay feed
151 Control relay for lambda probe, fuel pump and injectors
152 Fuse protecting injection system
167 Air flow meter (debimeter)
168 Timing sensor
201 Glow plug preheating control unit
228 Glow plugs (TD)
289 Thermal contact (PCT)
290 Heater coil (PCT)
291 Potentiometer on accelerator pedal
292 Clutch pedal switch
303 Diesel preheating protection fuse
304 Diesel preheating protection relay.
333 Injection control unit (JTD)
334 Dual engine temperature sensing unit
336 Injector 1 cyl (JTD)
337 Injector 2. cyl (JTD)
338 Injector 3. cyl (JTD)
339 Injector 4. cyl (JTD)
340 Injector 5. cyl (2387 JTD)
341 Fuel pressure regulator (JTD)
342 Fuel pressure sensor (JTD)
343 Turbo pressure sensor (JTD)
344 i.e. protection fuse (JTD)
345 Fuel temperature sensor (JTD)

**333** Injection control unit (JTD)




P4F904N02

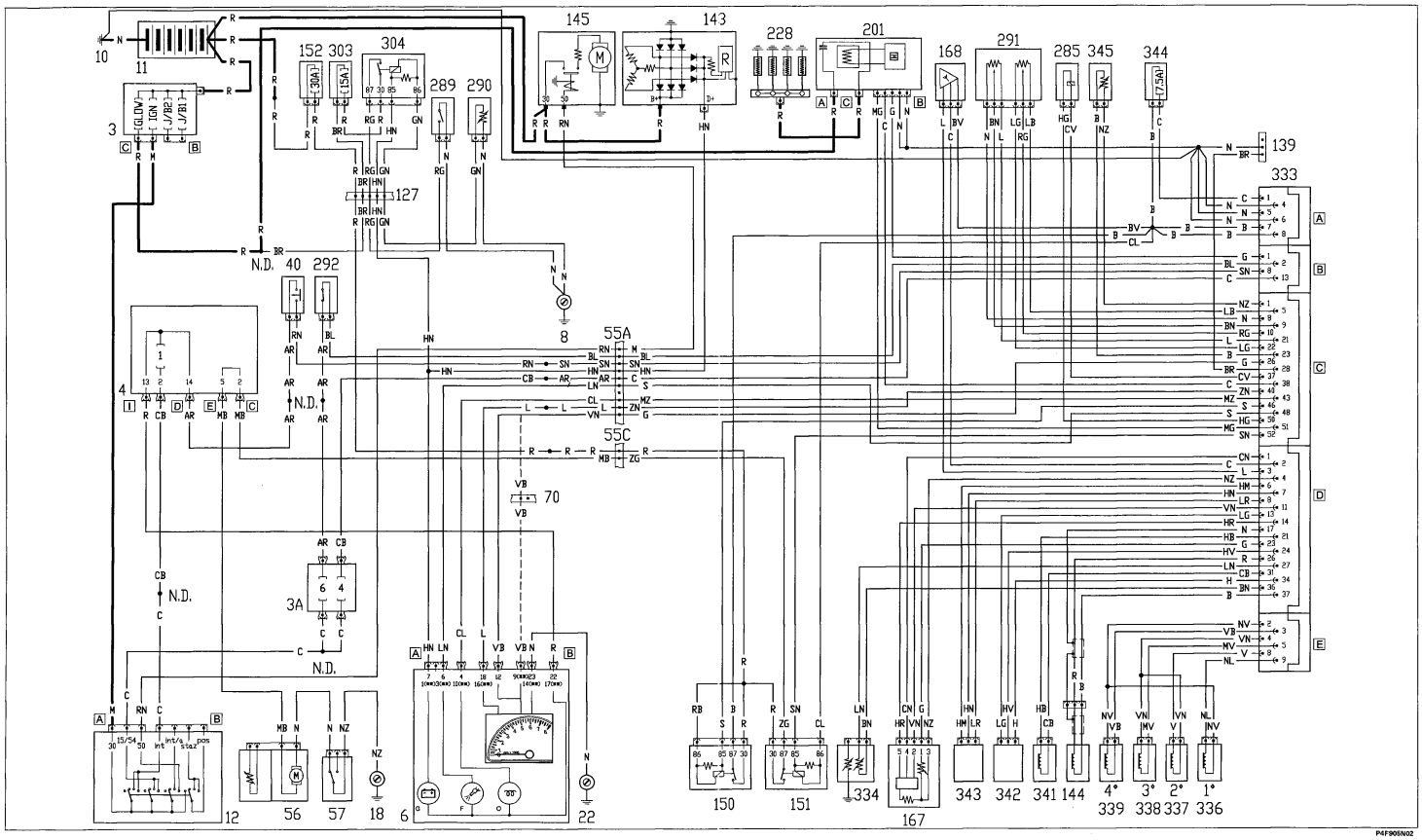
(*) The cables involved in the wiring diagram are marked with an asterisk.



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## 55.

**Starting - Electronic injection - Recharging and warning light - Low engine oil pressure warning light - Glow plug pre-heating warning light - Injection system failure warning light - Fuel preheating (1910 JTD)**



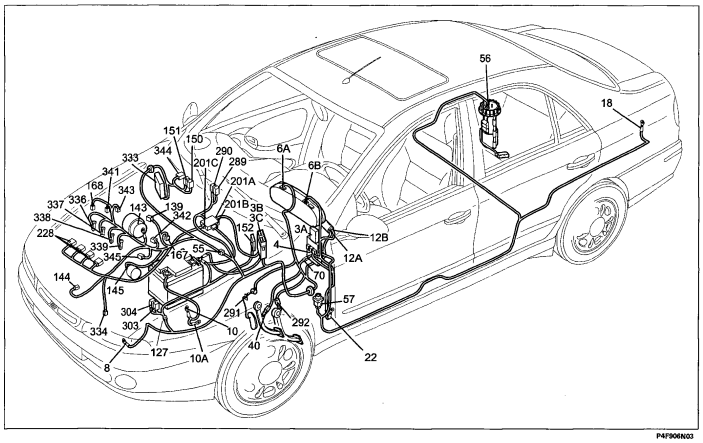

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## 55.

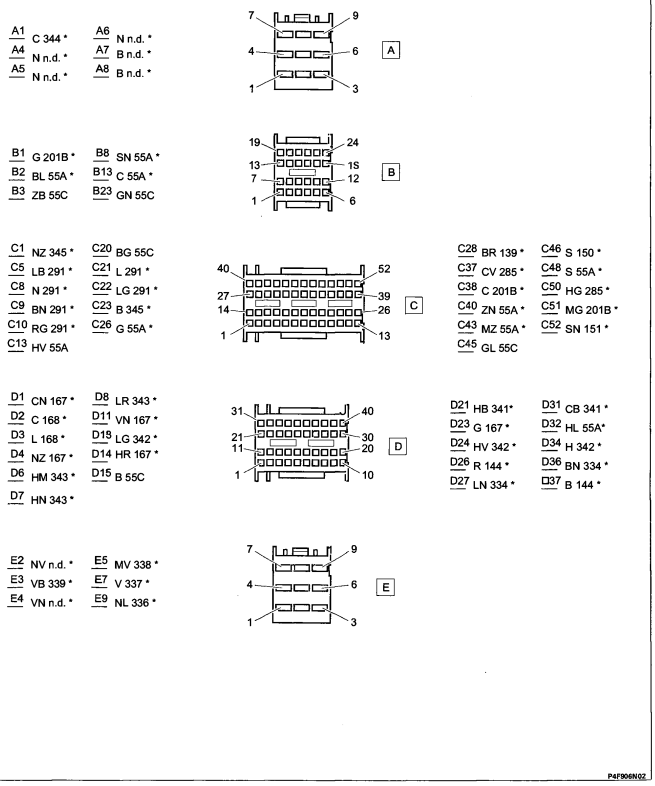



**Starting - Electronic injection - Recharging and warning light - Low engine oil pressure warning light - Glow plug preheating warning light - Injection system failure warning light - Fuel preheating (1910 JTD)**

Component key

3 Power fusebox
4 Junction unit
6 Instrument panel
8 Left front earth
10 Engine battery earth
12 Ignition switch
18 Left rear earth
22 Left facia earth
40 Brake lights control switch
55 Front/engine lead connection
56 Fuel level gauge control unit
57 Inertia switch
70 Connection between dashborad/front cables
127 Connection between front left cable/cable on relay holder bracket
139 Diagnostic socket for fuel injection
143 Alternator
144 Rpm and TDC sensor
145 Starter motor
150 Injection system relay feed
151 Control relay for lambda probe, fuel pump and injectors
152 Fuse protecting injection system
167 Air flow meter (debimeter)
168 Timing sensor
201 Glow plug preheating control unit
228 Glow plugs (TD)
289 Thermal contact (PCT)
290 Heater coil (PCT)
291 Potentiometer on accelerator pedal
292 Clutch pedal switch
303 Diesel preheating protection fuse
304 Diesel preheating protection relay.
333 Injection control unit (JTD)
334 Dual engine temperature sending unit
336 Injector 1 cyl (JTD)
337 Injector 2. cyl (JTD)
338 Injector 3. cyl (JTD)
339 Injector 4. cyl (JTD)
341 Fuel pressure regulator (JTD)
342 Fuel pressure sensor (JTD)
343 Turbo pressure sensor (JTD)
344 i.e. protection fuse (JTD)
345 Fuel temperature sensor (JTD)

**333** Injection control unit (JTD)



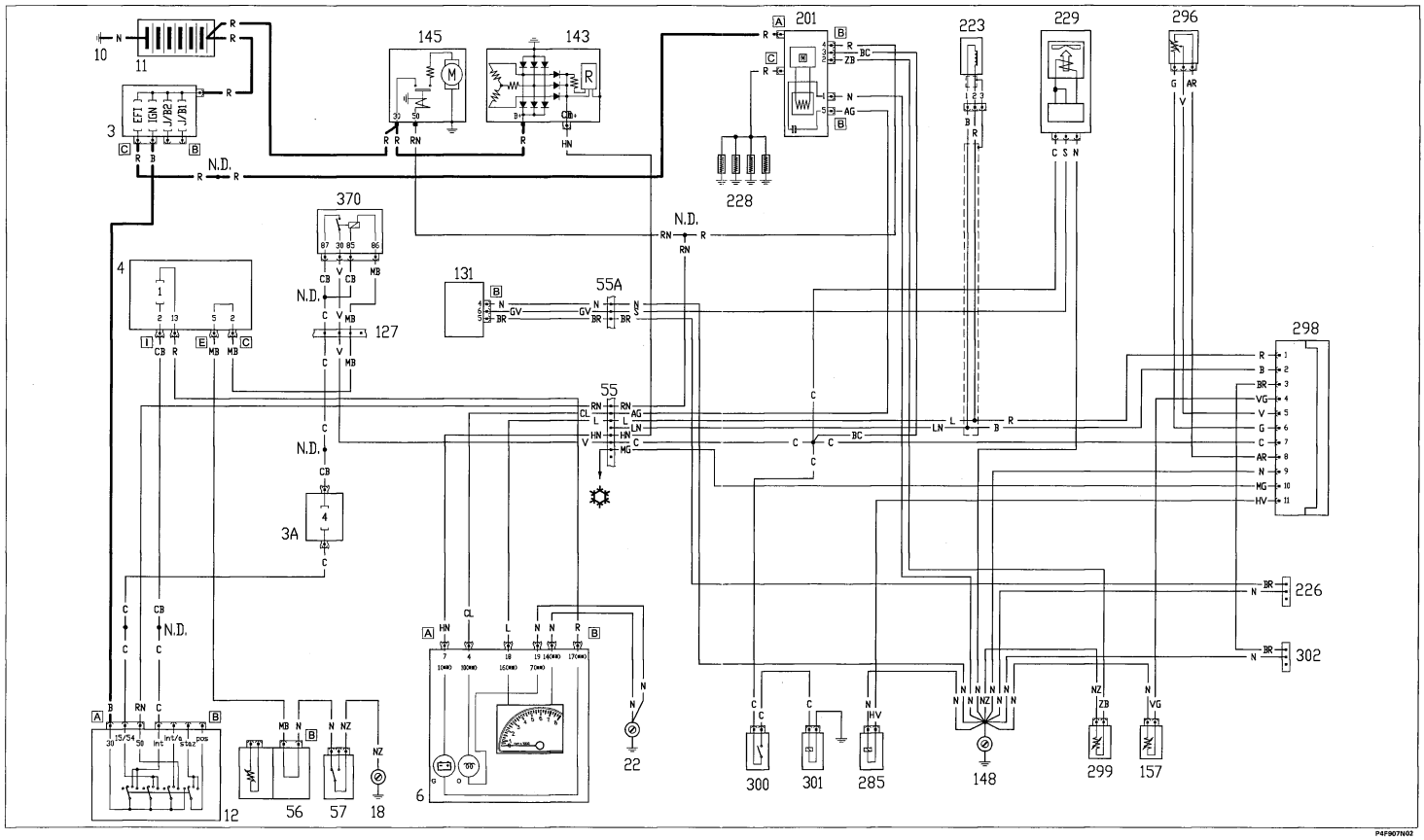

(*) The cables involved in the wiring diagram are marked with an asterisk.



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## 55.

**Starting - EGR control - Injection control - Heater plugs and warning light - Recharging and warning light - Insufficient engine oil pressure warning light (engine 1910-75)**

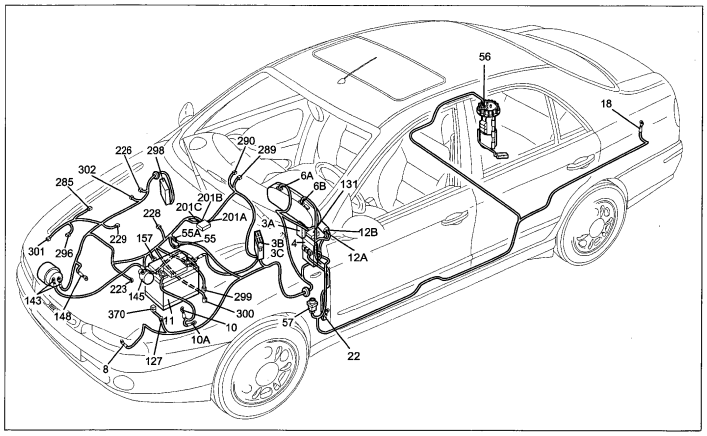



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## 55.




P4F908N06

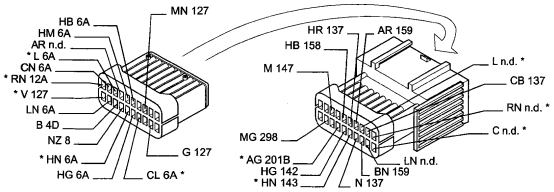
**Starting - Electronic injection - Recharging and warning light - Low engine oil pressure warning light - Glow plug preheating warning light - Injection system failure warning light - Fuel preheating (engine 1910-75)**

Component key

3 Power fusebox
4 Junction unit
6 Instrument panel
8 Left front earth
10 Engine battery earth
11 Battery
12 Ignition switch
18 Left rear earth
22 Left facia earth
55 Front/engine lead connection
57 Inertia switch
127 Connection between front left cable/cable on relay holder bracket
131 Fiat electronic control unit
143 Alternator
145 Starter motor
148 Earth for electronic injection
150 Injection system relay feed
157 Coolant temperature sensor for injection system
223 Rpm sensors
226 Tester socket for Fiat CODE system (1910 TD-75)
228 Glow plugs (TD)
229 Electric engine stop device (TD)
285 EGR control solenoid
289 Thermal contact (PCT)
290 Heater coil (PCT)
296 Accelerator control lever potentiometer
298 E.G.R electronic control system (1910 TD-75)
299 Coolant temperature sensor (preheating) (1910TD-75)
300 K.S.B. thermal switch (1910TD-75)
301 KSB device (1910TD-75)
302 Tester socket for EGR system (1910 TD-75)
370 Inertia switch relay (1910 TD-75)

### 55 Front/engine lead connection

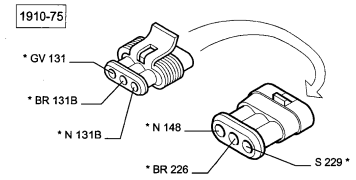
1910-75




P4F908N07

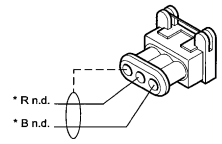
### 55A Front/engine lead connection

1910-75




P4F908N03

### 223 RPM sensor

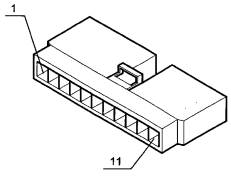



P4F908N04

### 298 EGR electronic control unit (1910TD-75)

1910-75

| | | | |
|---|---|---|---|
| 1 | R n.d. * | 7 | C n.d. * |
| 2 | B n.d. * | 8 | AR 296 * |
| 3 | BR 229* | 9 | N 148 * |
| 4 | VG 157 * | 10 | MG 55 * |
| 5 | V 296 * | 11 | HV 285 * |
| 6 | G 296* | | |




P4F908N05

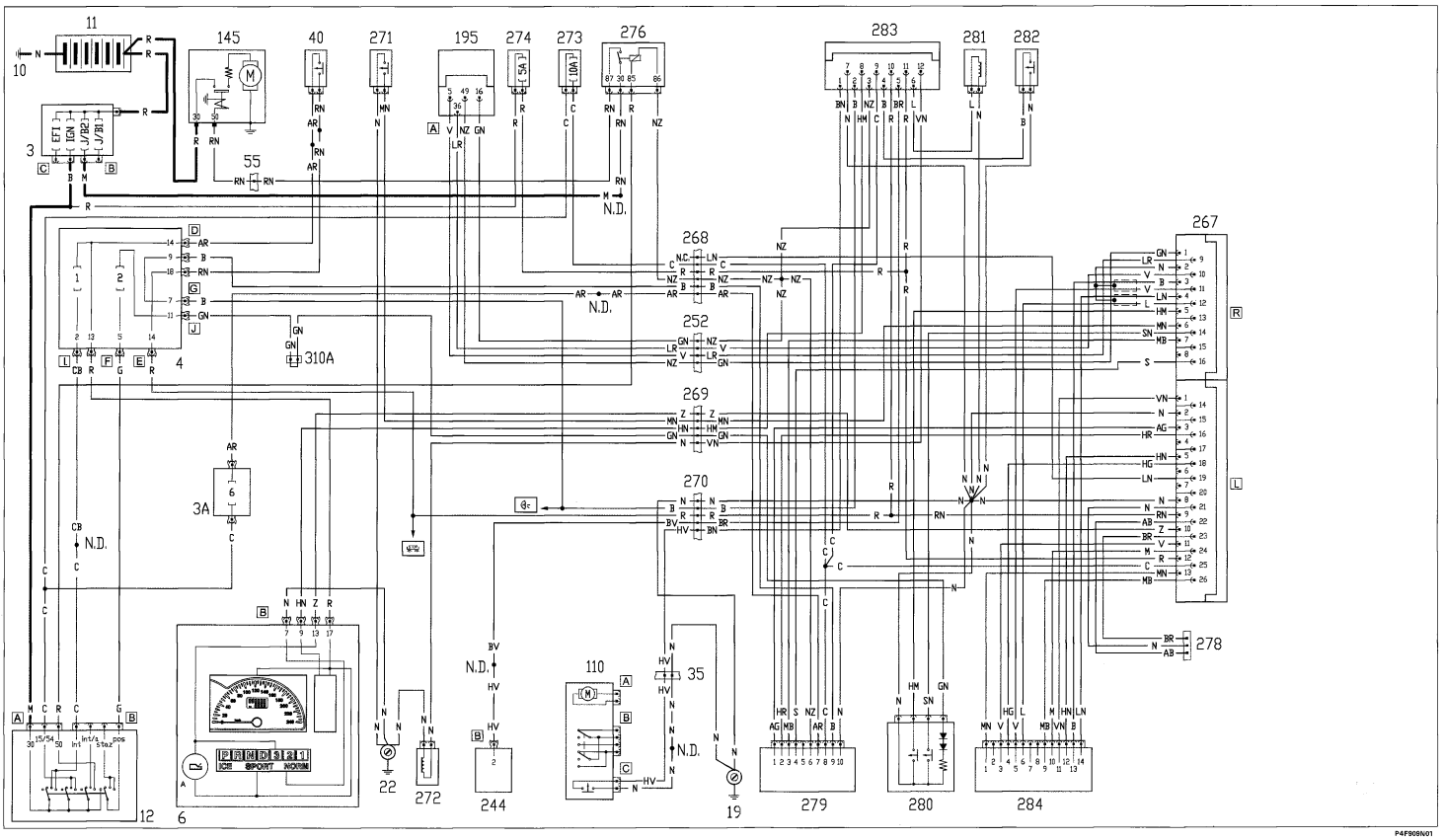
(*) The cables involved in the wiring diagram are marked with an asterisk.



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## 55.

**Automatic transmission - System failure warning light ( 1581 c.a. engine)**

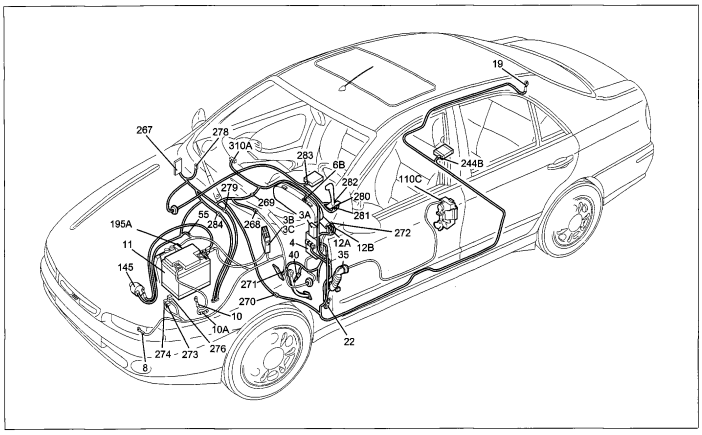



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## 55.



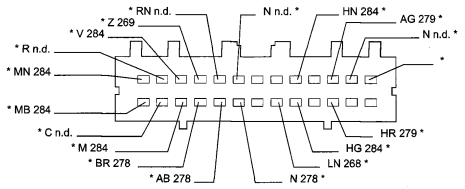

P4F910N01

**Automatic transmission - System failure warning light ( 1581 c.a. engine)**

Key to components

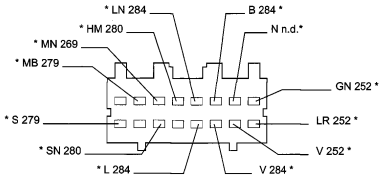
3 Direction indicator
4 Junction unit
6 Instrument panel
8 Left front earth
10 Battery earth on engine
11 Battery
12 Ignition switch
19 Right rear earth
22 Left facia earth
35 Connection between dashboard/left front door cables
40 Brake lights control switch
55 Connection between front/engine cables
110 Left front central locking
145 Starter motor
195 Injection/ignition electronic control unit (1581)
244 Integrated services electronic control unit
267 Automatic transmission control unit
268 Connection between automatic transmission/front cables
269 Connection between automatic transmission/dashboard cables
270 Connection between automatic transmission/rear cables
271 Kick-down switch
272 Ignition switch electro-magnet
273 Automatic transmission protective fuse
274 Automatic transmission protective fuse
276 Starting go ahead relay
278 Diagnostic socket for automatic transmission
279 Automatic transmission gear selector
280 ICE/SPORT selector for automatic transmission
281 Shift Lock solenoid
282 Additional PARK interruption for automatic transmission
283 Safety control unit for automatic transmission
284 Automatic transmission connection on gearbox
310 K.S.B. thermal switch (1910TD-75)

**267L** Automatic transmission control unit



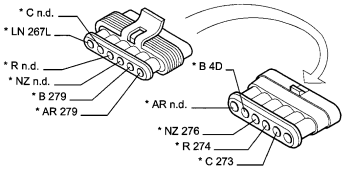

P4F910N02

**267R** Automatic transmission control unit



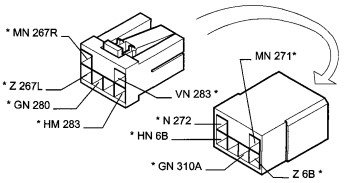

P4F910N03

**268** Connection between automatic transmission/front cables




P4F910N04

**269** Connection between automatic transmission/dashboard cables




P4F910N05

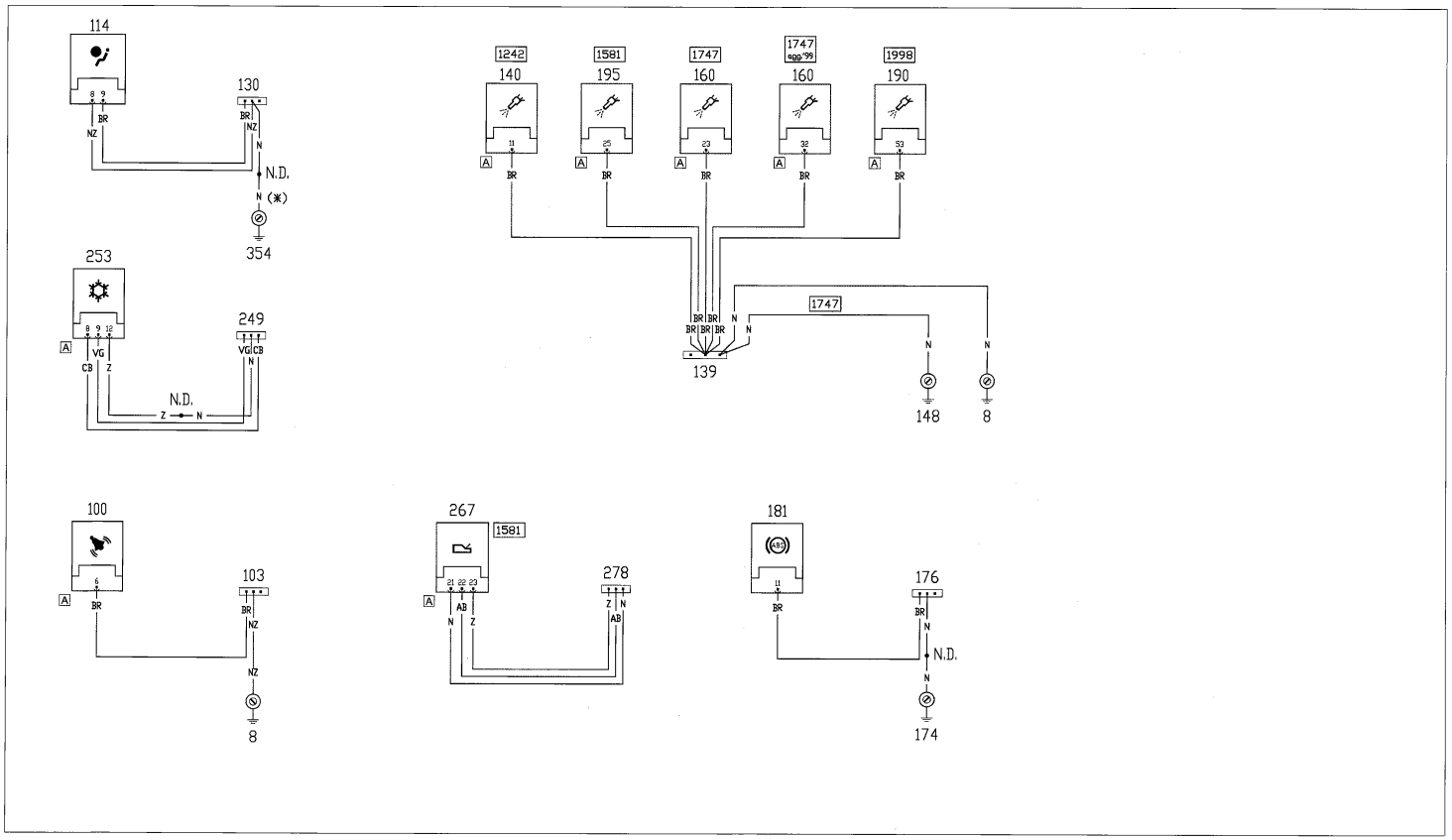
* The cables concerned are marked in the wiring diagram with an asterisk.



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## 55.

**Diagnostic socket connections ( petrol engine)**



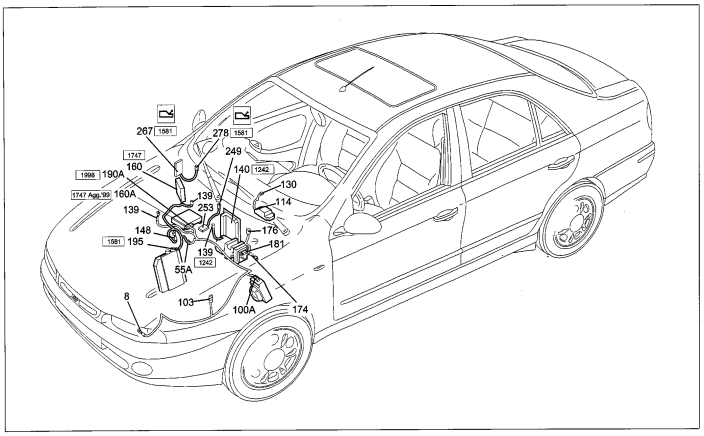

* Version with Side Bag

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## 55.



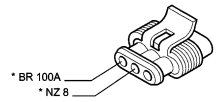

P4F912N01

**Diagnostic socket connections ( petrol engine)**

Key to components

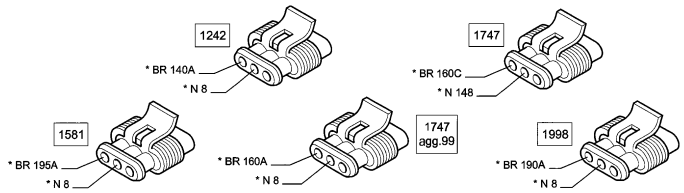
8 Left front earth
55 Connection between front/engine cables
100 Alarm electronic control unit
103 Diagnostic socket for alarm
114 Electronic control unit Air Bag
130 Diagnostic socket for Air Bag
139 Diagnostic sockect for injection system
140 Injection/ignition control unit (1242)
148 Earth for electronic injection
160 Injection/ignition electronic control unit (1747)
174 Power earth for A.B.S.
176 Diagnostic socket for A.B.S.
181 A.B.S. electro-hydraulic control unit
190 Injection/ignition electronic control unit (1998)
195 Injection/ignition electronic control unit (1581)
249 Diagnostic socket for climate control system
267 Automatic transmission control unit
278 Automatic transmission diagnostic socket

**103** Diagnostic socket for alarm



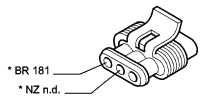

P4F912N02

**139** Diagnostic sockect for injection system



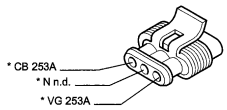

P4F912N03

**176** Diagnostic socket for A.B.S.




P4F912N04

**249** Diagnostic socket for climate control system




P4F912N05

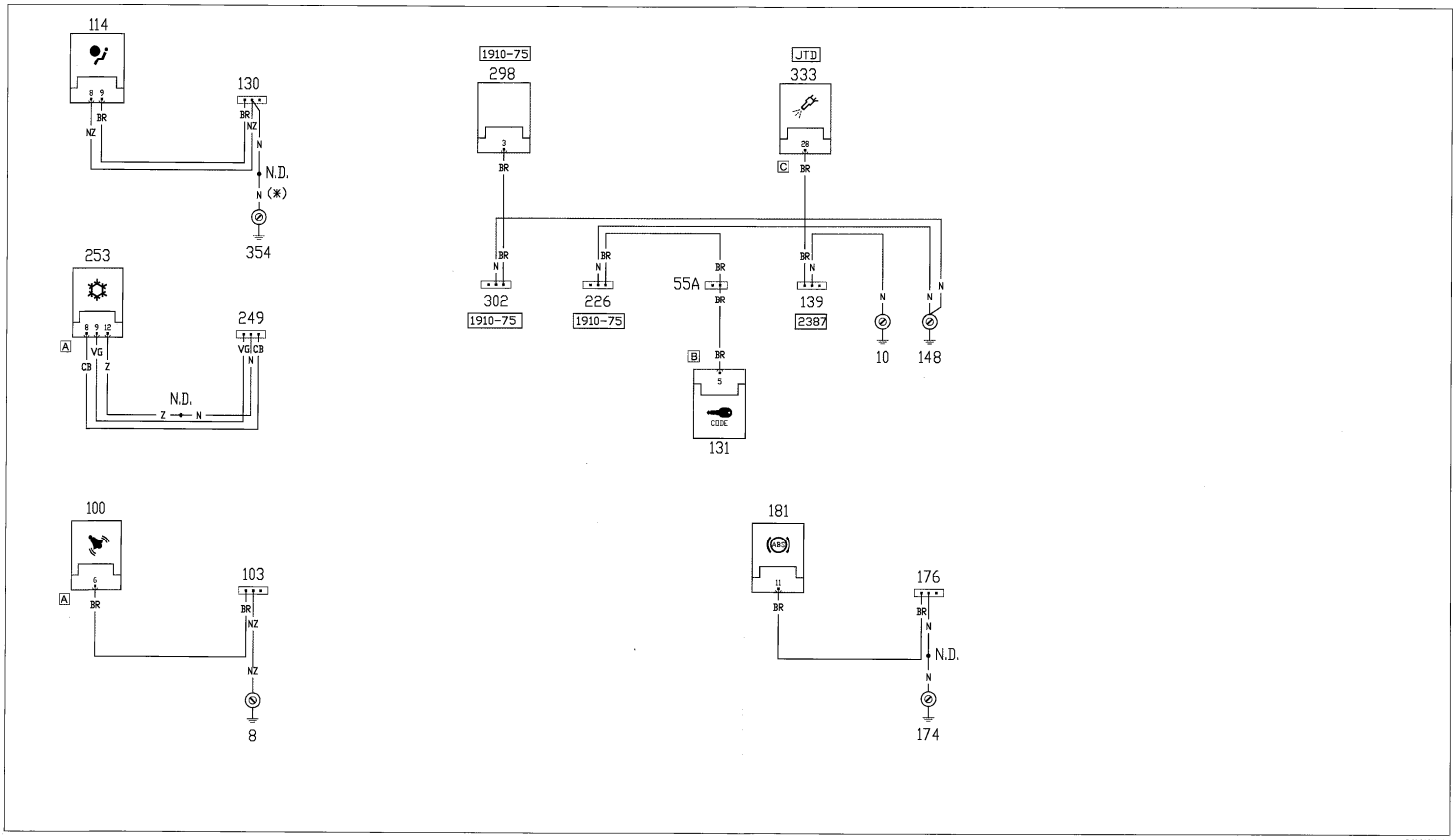
* The cables concerned are marked in the wiring diagram with an asterisk.



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## 55.

**Diagnostic socket connections ( diesel engine)**



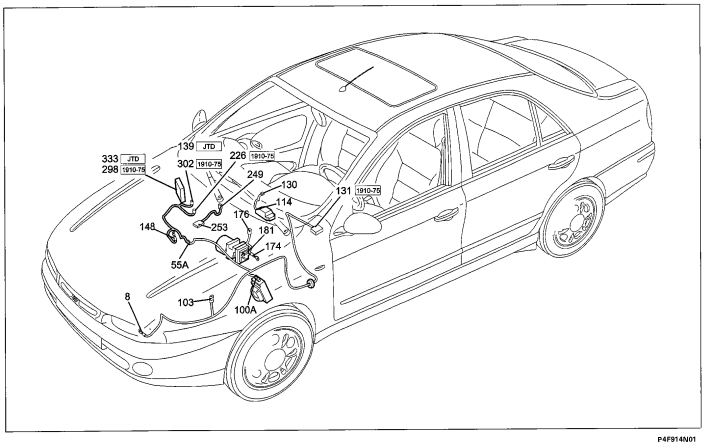

P4F913N01

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## 55.



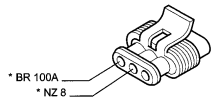

P4F914N01

**Diagnostic socket connectins ( diesel engine)**

Key to components

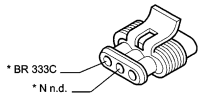
8 Left front earth
55 Connection between front/engine cables
100 Alarm electronic control unit
103 Diagnostic socket for alarm
114 Air Bag electronic control unit
130 Diagnostic socket for Air Bag
131 FIAT CODE electronic control unit
139 Diagnostic sockect for injection system
148 Earth for electronic injection
174 Power earth for A.B.S.
176 Diagnostic socket for A.B.S.
181 A.B.S. electro-hydraulic control unit
226 Diagnostic socket for FIAT CODE system (1910 TD-75)
249 Diagnostic socket for climate control system
253 Climate control unit
298 E.G.R. electronic control unit (1910TD-75)
298 E.G.R. electronic control unit (1910TD-
302 75)
Diagnostic socket for EGR system (1910TD-75)
333 Injection control unit (JTD)

**103** Diagnostic socket for alarm



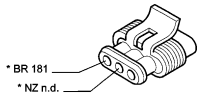

P4F914N02

**139** Diagnostic sockect for injection system



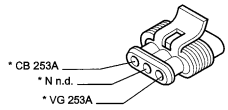

P4F914N03

**176** Diagnostic socket for A.B.S.




P4F914N04

**249** Diagnostic socket for climate control system




P4F914N05

* The cables concerned are marked in the wiring diagram with an asterisk.



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| DESCRIPTION | Marea-Marea Weekend | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | SX | | ELX | | | | | HLX | |
| | 1242 | 1910 TD-75 | 1581 | 1581 a.c. | 1747 | 1747 agg. 99 | 1910 JTD | 1998 | 2387 JTD |
| Versions with Check Panel, polyelliptical headlamps<br>Side lights and warning light - Dipped headlamps - Main beam headlamps and warning light - Number plate lights | - | - | 5 (*) | 5 (*) | 5 (*) | 5 (*) | 5 (*) | 5 (*) | 5 (*) |
| Versions without Check Panel, polyelliptical headlamps<br>Side lights and warning light - Dipped headlamps - Main beam headlamps and warning light - Number plate lights | - | - | 7 (●) | 7 (●) | 7 (●) | 7 (●) | 7 (●) | - | - |
| Versions without Check Panel, reflector headlamps<br>Side lights and warning light - Dipped headlamps - Main beam headlamps and warning light - Number plate lights | 9 (●) | 9 (●) | - | - | - | - | - | - | - |
| Fog lights - Rear fog lamps | 11 (●) | 11 (●) | 11 (●) | 11 (●) | 11 (●) | 11 (●) | 11 (●) | 11 (●) | 11 (●) |
| Versions with Check Panel and alarm<br>Direction indicators and warning light - Hazard warning lights - Brake lights - Reversing light | - | - | 13*<br>14a** | 13*<br>14a** | 13*<br>14a** | 13*<br>14a** | 13*<br>14a** | 13*<br>14a** | 13*<br>14a** |
| Versions with Check Panel, without alarm<br>Direction indicators and warning light - Hazard warning lights - Brake lights - Reversing light | - | - | 15*<br>16a** | 15*<br>16a** | 15*<br>16a** | 15*<br>16a** | 15*<br>16a** | 15*<br>16a** | 15*<br>16a** |
| Versions without Check Panel, with alarm<br>Direction indicators and warning light - Hazard warning lights - Brake lights - Reversing light | 17 (●) | 17 (●) | 17 (●) | 17 (●) | 17 (●) | 17 (●) | 17 (●) | - | - |
| Versions without Check Panel, without alarm<br>Direction indicators and warning light - Hazard warning lights - Brake lights - Reversing light | 19 (●) | 19 (●) | 19 (●) | 19 (●) | 19 (●) | 19 (●) | 19 (●) | - | - |
| Fiat Marea<br>Car interior ghting - Symbol lighting | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| Fiat Marea Weekend<br>Car interior lighting - Symbol lighting | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
| Radio system (high level: AD 185 H) - Cigarette lighter | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| Radio system (mid-level: AD 185 M) - Cigarette lighter | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 |
| Electric front windows | 29 | 29 | 29 | 29 | 29 | 29 | 29 | 29 | 29 |
| Rear electric windows | - | - | 31 | 31 | 31 | 31 | 31 | 31 | 31 |
| FIAT CODE and warning light | 33 | 35 | 33 | 33 | 33 | 33 | 35 | 33 | 35 |

**NOTE** *The numbers in the table correspond to the page number of the wiring diagram*

* From November '99 (●) A partire da febbraio 2000, vedere schema corrispondente in "Marea-Marea Weekend EURO3/EOBD" ** Only up to November '99

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| DESCRIPTION | Marea-Marea Weekend | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | SX | | ELX | | | | | HLX | |
| | 1242 | 1910 TD-75 | 1581 | 1581 a.c. | 1747 | 1747 agg. 99 | 1910 JTD | 1998 | 2387 JTD |
| Alarm/Door check device | 37* 38a** | 37* 38a** | 37* 38a** | 37* 38a** | 37* 38a** | 37* 38a** | 37* 38a** | 37* 38a** | 37* 38a** |
| Central locking | 39 | 39 | 39 | 39 | 39 | 39 | 39 | 39 | 39 |
| Electrically-adjustable, heated door mirror | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 |
| Predisposition for car phone and TELEPASS | 43 | 43 | 43 | 43 | 43 | 43 | 43 | 43 | 43 |
| Electric sun-roof | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 |
| Headlamp alignment corrector | 47 (●) | 47 (●) | 47 (●) | 47 (●) | 47 (●) | 47 (●) | 47 (●) | 47 (●) | 47 (●) |
| Adjustable, heated front seats | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 |
| Air Bag, pretensioners and failure warning light | 51 | 51 | 51 | 51 | 51 | 51 | 51 | 51 | 51 |
| Air Bag with Side Bag and pretensioners and failure warning light | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 |
| Windscreen wash/wipe - Rear wash/wipe - Horn - Heated rear window - Headlamp washers | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 |
| Instrument panel connections | 57* 58a** | 57* 58a** | 57* 58a** | 57* 58a** | 57* 58a** | 57* 58a** | 57* 58a** | 57* 58a** | 57* 58a** |
| Check Panel/Door check connections | - | - | 59* 60a** | 59* 60a** | 59* 60a** | 59* 60a** | 59* 60a** | 59* 60a** | 59* 60a** |
| Thermostatically-controlled climate control system/heater | 73 | 71 | 69 | 69 | 67 | 65 | 63 | 61 | 63 |
| Additional heater | - | - | - | - | - | - | 75 | - | 75 |
| Versions with climate control Engine cooling | 85 | 87 | 85 | 85 | 83 | 77 | 81 | 77 | 79 |
| Versions without climate control Engine cooling | 89 | 87 | 89 | 89 | 89 | 89 | 81 | 89 | 79 |

**NOTE** *The numbers in the table correspond to the page number of the wiring diagram*

* From November '99 (●) Starting from February 2000, see wiring diagram for "Marea-Marea Weekend EURO3/EOBD" ** Only up to November '99



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| DESCRIPTION | Marea-Marea Weekend | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | SX | | ELX | | | | | HLX | |
| | 1242 | 1910 TD-75 | 1581 | 1581 a.c. | 1747 | 1747 agg. 99 | 1910 JTD | 1998 | 2387 JTD |
| Anti-locking braking system (ABS) and failure warning light | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 |
| Starting - Electronic ignition and injection - Recharging and warning light - Insufficient engine oil pressure warning light - Injection system failure warning ilight - Rev couner | 101 | - | 99 | 99 | 97 | 95 | - | 93 | - |
| Starting - Electronic injection - Recharging and warning light - Low engine oil pressure warning light - Glow plug preheating warning light - Injection system failure warning light - Fuel preheating | - | - | - | - | - | - | 105 | - | 103 |
| Starting - EGR control - Injection control - Glow plug preheating and warning light - Recharging and warning light - Low engine oil pressure warning light | - | 107 | - | - | - | - | - | - | - |
| Automatic transmission device - System failure warning light | - | - | - | 109 | - | - | - | - | - |
| Diagnostic sockect connections | 111 | 113 | 111 | 111 | 111 | 111 | 113 | 111 | 113 |
| Manually operated heater | 114a | | | | | | | | |

**NOTE** *The numbers in the table correspond to the page number of the wiring diagram*

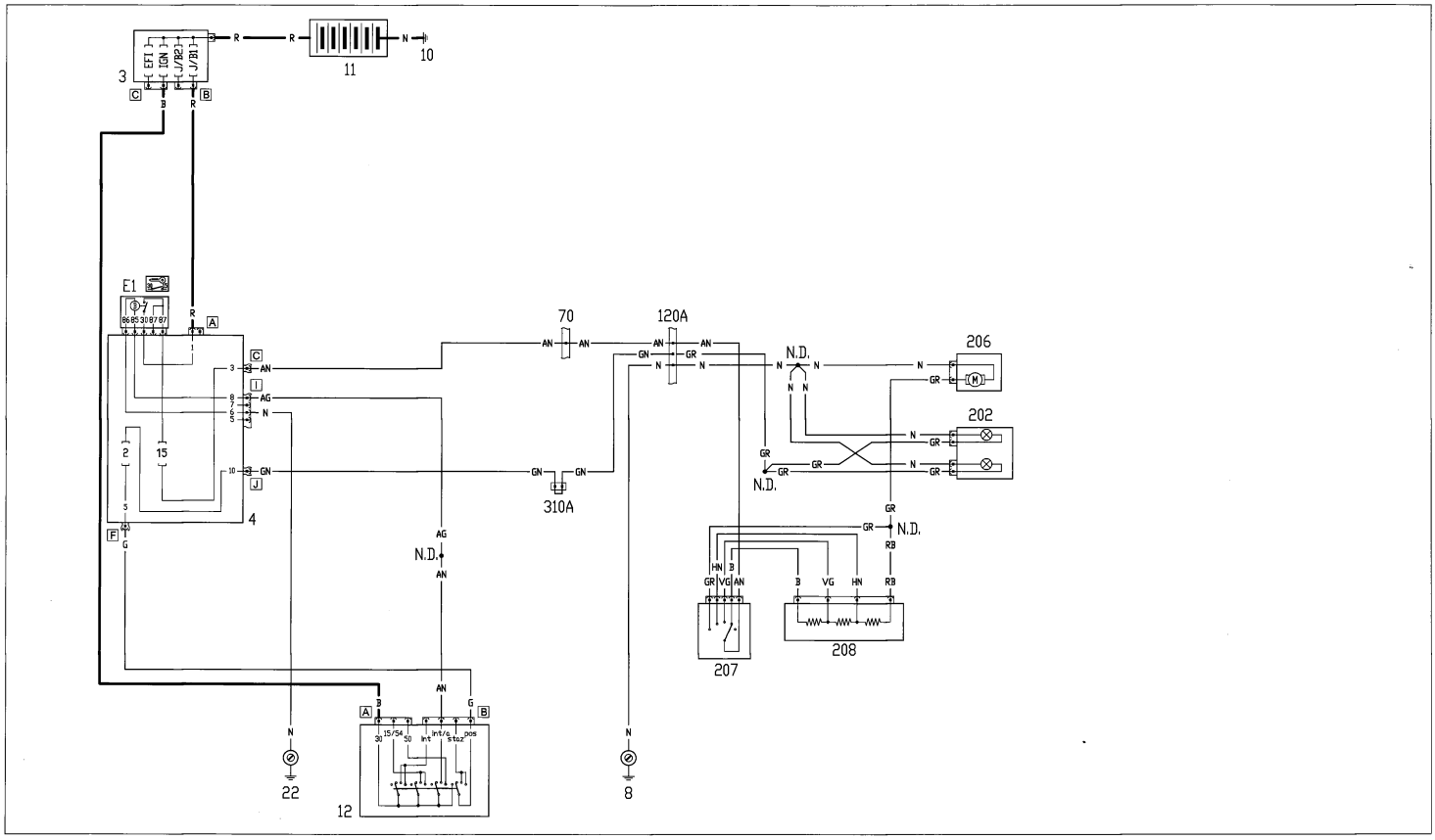
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## 55.

**Manually operated heater (1242)**

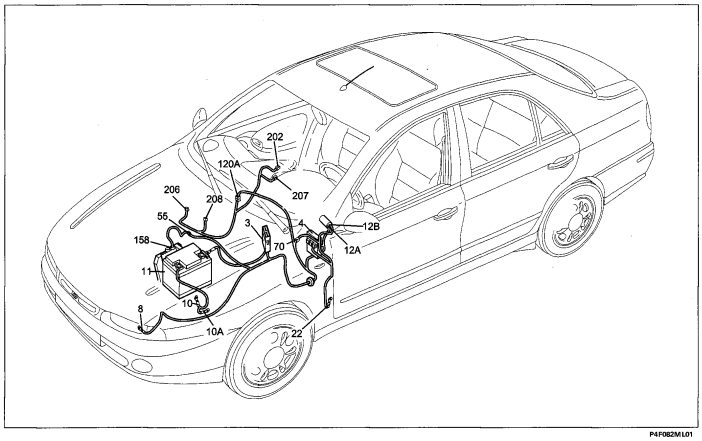



P4F081MLI01



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## 55.




P4F082ML01

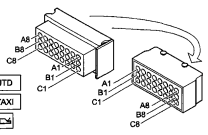
**Manually operated heater (1242)**

Component key

3 power fusebox:
4 Junction unit:
8 Left front earth
10 Engine battery earth
10A Battery earth on bodyshell
11 Battery
12 Ignition switch
22 Left facia earth
55 Connection between front/engine cables
70 Connection between dashborad/front cables
120 Heater cables connection
202 Heater/air conditioner unit control symbol lighting bulbs
206 Climate control system fan
207 Fan speed adjustment switch
208 Resistance for fan speed
310 Connection bridge
N.D. Connection bridge

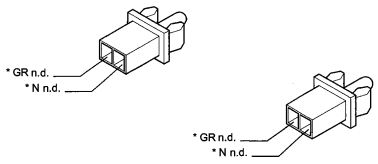
### 70 Connection for front dashboard cables

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | RN 4C | B1 | M 29 | C1 | AN 4C * | A1 | RN 120 | B1 | M 310C | C1 | AN 120 * |
| A2 | VG 127 | B2 | V 328 | C2 | HR 100B | A2 | VG 120 | B2 | V 28A | C2 | HR 28B |
| A3 | H 100B | B3 | AG n.d. | C3 | HN 100B | A3 | H 6B | B3 | AG 4I | C3 | HN 28B |
| A4 | HL 6A | B4 | LN 100B | C4 | HG 100B | A4 | HL120 | B4 | AB 4I | C4 | HG 28B |
| A5 | CB 100A | B5 | BN 375 | C5 | HV 100B | A5 | CB 28A | B5 | BN 120 | C5 | HV 28B |
| A6 | S 100B | B7 | AN 4C | C7 | GV 335 JTD | A6 | R n.d. | B6 | B 117 | C7 | GV 6B JTD |
| A7 | V 100A | B6 | B 375 | C8 | RB 307 TAXI | A7 | A 34A | B7 | AN 120 | C8 | RB 312 TAXI |
| A8 | N 8 | B8 | MN n.d. | C8 | GN 195A | A8 | N 312 | B8 | RN 315 | C8 | GN 6B |



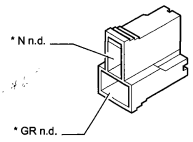

P4F082ML02

### 202 Heater/air conditioning unit control ideogram light bulbs



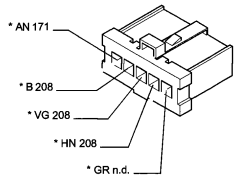

P4F082ML03

### 206 Car interior climate control fan




P4F082ML04

### 207 Fan speed adjustment switch




P4F082ML05

(*) The cables involved in the wiring diagram are marked with an asterisk.



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Key to components

| | |
|---|---|
| 1 | Left front light cluster |
| 2 | Right front light cluster |
| 3 | Power fuse box |
| 4 | Junction unit |
| 5 | Dipped headlamps relay feed |
| 6 | Instrument panel |
| 7 | Steering column switch unit |
| 8 | Left front earth |
| 9 | Right front earth |
| 10 | Battery earth on engine |
| 10A | Battery earth on bodyshell |
| 11 | Battery |
| 12 | Ignition switch |
| 13 | Connection between right/left front cables |
| 14 | Left no. plate light |
| 15 | Right no. plate light |
| 16 | Left rear light cluster |
| 17 | Right rear light cluster |
| 18 | Left rear earth |
| 19 | Right rear earth |
| 20 | Left front side direction indicator |
| 21 | Right front side direction indicator |
| 22 | Left dashboard earth |
| 23 | Hazard warning lights control switch unit |
| 24 | Windscreen wiper motor |
| 25 | Electric windscreen/rearscreen washer pump |
| 26 | Rearscreen wiper motor |
| 27 | Connection between dashboard/rear cables |
| 28 | Connection between front/fog light cables |
| 30 | Left fog light |
| 31 | Right fog light |
| 32 | Fog lights relay feed |
| 34 | Switch control unit |
| 35 | Connection between dashboard/left front door cables |
| 36 | Connection between dashboard/right front door cables |
| 39 | Heated rear windscreen |
| 40 | Brake lights control switch |
| 41 | Additional brake light |
| 42 | Right dashboard earth |
| 43 | Electrical actuator for left headlamp alignment |
| 44 | Electrical actuator for right headlamp alignment |
| 45 | Headlamp alignment control unit |
| 46 | Left low tone horn |
| 47 | Right high tone horn |
| 48 | Radio receiver with clock |
| 49 | Left front speaker (tweeter) |
| 50 | Right front speaker (tweeter) |
| 52 | Speaker in right front door |
| 53 | Left rear speaker |
| 54 | Right rear speaker |
| 55 | Connection between front/engine cables |
| 56 | Fuel gauge assembly |
| 57 | Inertia switch |
| 58 | Instrument panel light dimmer |
| 64 | Glove compartment light with switch incorporated |
| 65 | Luggage compartment light |
| 66 | Control panel for electrically adjustable external rear view mirrors |
| 67 | Left external rear view mirror |
| 68 | Right external rear view mirror |
| 69 | Cigar lighter |
| 70 | Connection between dashboard/front cables |
| 73 | Control panel for electric front windows on left armrest |
| 74 | Control panel for right front electric window on right armrest |
| 76 | Left front electric window motor |
| 77 | Right front electric window motor |
| 78 | Control panel for electric rear windows on left front door |
| 80 | Electric rear windows inhibitor switch |
| 82 | Control panel for left rear electric window on left rear door |
| 83 | Control panel for right rear electric window on right rear door |
| 84 | Left rear electric window motor |
| 85 | Right rear electric window motor |
| 86 | Connection between rear/left rear door cables |
| 87 | Connection between rear/right rear door cables |
| 88 | Insufficient brake fluid level sensor |
| 89 | Left brake pad wear sensor |
| 89A | Connection for left wheel brake pad wear sensor cables |
| 90 | Switch signalling handbrake applied |
| 92A | Connection for electrical sun roof cables |
| 93A | Electric sun roof control unit |
| 95 | Connection between front/A.B.S. anti-lock brakes cables |
| 96 | A.B.S. anti-lock brakes protective power fuse |
| 97 | Electric headlamp washer pump |
| 98 | Headlamp washer intermittent device |
| 100 | Alarm electronic control unit |
| 103 | Diagnostic socket for alarm |
| 105 | Alarm off switch |
| 106 | Alarm switch on bonnet lid |



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107A Central locking remote control receiver
107B Front courtesy light
108 Left rear central locking
109 Right rear central locking
110 Left front central locking
111 Right front central locking
114 Air Bag electronic control unit
115 Passenger Air Bag
116 Driver's Air Bag
117 Connection between Air Bag/dashboard cables
120 Connection for air conditioning cables
121 Three stage pressure switch
122 Engine cooling fan low speed relay
122 Engine cooling fan low speed relay
123 Engine cooling fan high speed timer
124 Air conditioning compressor relay feed
127 Connection between left front cable/cable on relay holder bracket
128 Connection between front/radiator cables
129 Engine cooling fan protective power fuse
129A 2nd engine cooling fan protective power fuse
130 Diagnostic socket for Air Bag
131 FIAT CODE electronic control unit
132 Petrol vapour cut out solenoid valve
134 Connection between rear/heated driver's seat cables
134A Driver's seat heater pad
135 Connection between rear/heated passenger seat cables
135A Passenger seat heater pad
136 Detonation sensor
136A 2nd detonation sensor
137 Vehicle speed sensor
138 Idle adjustment actuator
139 Diagnostic socket for injection system
140 Injection/ignition control unit (1242)
141 Heated Lambda sensor
142 Switch signalling insufficient engine oil pressure
143 Alternator
144 Rpm and TDC sensor
145 Starter motor
146 Potentiometer on butterfly valve
147 Compressor for air conditioning
148 Earth for electronic injection
150 Injection system relay feed
151 Relay for Lambda sensor, electric fuel pump, injectors
152 Injection system protective fuse
152A Injection system protective fuse
152B Injection system protective fuse
154 Engine cooling fan
155 Ignition coils
156 Spark plugs
157 Water temperature sensor for injection system
158 Water temperature sensor for instrument
159 Reversing lights control switch
160 Injection/ignition electronic control unit (1747)
161 Ignition power module
162 Injector (1)
163 Injector (2)
164 Injector (3)
165 Injector (4)
165A Injector (5) (1998)
166 Idle adjustment actuator
167 Air flow meter
168 Timing sensor
170 Resistor for engine cooling fan
174 Power earth for A.B.S.
176 Diagnostic socket for A.B.S.
177 Sensor on left front wheel for A.B.S.
178 Sensor on left rear wheel for A.B.S.
179 Sensor on right front wheel for A.B.S.
180 Sensor on right rear wheel for A.B.S.
181 A.B.S. electro-hydraulic control unit
182 Right wheel brake pad wear sensor
182A Connection for right wheel brake pad wear sensor cables
183 Ignition coil (1)
184 Ignition coil (2)
185 Ignition coil (3)
186 Ignition coil (4)
187 Ignition coil (5) (1998)
189 Phase transformer
190 Injection/ignition electronic control unit (1998)
193 Earth for electronic injection
194 Connection between injection/injector bridge cables
195 Injection/ignition electronic control unit (1581)
199 Aerial for FIAT CODE
201 Heater plugs control unit
202 Heater/air conditioning controls ideogram lights
203 Car interior climate control fan
204 Fan speed adjustment switch
209 Intake air flap control actuator
211 Frost sensor
222 Earth for climate control system
223 Rpm sensor
226 Diagnostic socket for FIAT CODE system (1910 TD-75)
227 Diagnostic socket for injection system (1747)
228 Heater plugs (TD)

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229 Engine cut out electrostop (TD)
231 Clock spring connection
232 Earth for compressor
233 Thermal relay on water pump
235 Connection for air conditioning compressor cables
236 Connection between rear cable and tailgate
238 Rear electric windows control unit
239 Connection between Air Bag/left pretensioner cables
240 Connection between Air Bag/right pretensioner cables
241 Left pretensioner
242 Right pretensioner
243 Luggage compartment light button
244 Integrated services electronic control unit
245 Rear courtesy light
248 Radio controls on steering wheel
249 Diagnostic socket for climate control system
250 Fuel pump protective fuse
252 Connection between automatic transmission/engine cables
253 Climate control unit
254 Climate control controls with passenger compartment temperature sensor
255 Electronic speed transfomer for climate control fan
256 Mixing air control actuator
257 Fuel pump relay feed
258 Treated air temperature sensor
259 Temperature adjustment switch
260 MAX-DEF microswitch
261 Tailgate locking/unlocking actuator
262 Seat belts warning light switch
264 Left rear courtesy light
265 Right rear courtesy light
267 Automatic transmission control unit
268 Connection between automatic transmission/front cables
269 Connection between automatic transmission/dashboard cables
270 Connection between automatic transmission/rear cables
271 Kick-down switch
272 Ignition switch electro-magnet
273 Automatic transmission system protective fuse
274 Automatic transmission system protctive fuse
276 Starting go ahead relay
277 Diagnostic socket for automatic transmission
279 Automatic transmission gear selector
280 ICE/SPORT selector for automatic transmission
281 Shift Lock electro-magnet
282 Additional PARK interruption for automatic transmission
283 Safety control unit for automatic transmission
284 Automatic transmission connection on gearbox
285 E.G.R. solenoid valve
289 Thermal contact (PCT)
290 Heater resistor (PCT)
291 Accelerator pedal potentiometer
292 Clutch pedal switch
296 Accelerator control lever potentiometer
298 E.G.R. electronic control unti (1910 TD-75)
299 Water temperature sensor (pre-heating) (1910 TD-75)
300 K.S.B. thermal switch (1910 TD-75)
301 KSB device (1910 TD-75)
302 Diagnostic socket for EGR system (1910 TD-75)
303 Diesel pre-heating protective fuse
304 Diesel pre-heating protective relay
305 Compressor disconnection relay
310A Connecting bridge
310B Connecting bridge
310C Connecting bridge
310D Connecting bridge
310E Connecting bridge
310F Connecting bridge
319 Connection for radio phone
320 Aerial feeder
321 Connection for TELEPASS
322 Connection for seat height adjustment
323 Connectino for seat lumbar adjustment
325 Additional heater connection
326 Additional heater control unit
328 Hazard warning lights relay
332 Power relay controlled by ignition
333 Injection control unit (JTD)
334 Engine temperature twin sender unit
336 Injector for cylinder 1 (JTD)
337 Injector for cylinder 2 (JTD)
338 Injector for cylinder 3 (JTD)
399 Injector for cylinder 4 (JTD)
340 Injector for cylinder 5 (JTD)
341 Fuel pressure regulator (JTD)
342 Fuel pressure sensor (JTD)
343 Turbo pressure sensor (JTD)
344 I.E. protective fuse (JTD)
345 Fuel temperature sensor (JTD)
346 Additional heater relay
347 Additional heater relay
347 Additional heater remote control switch

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| | |
|---|---|
| 349 | Additional heater protective fuse |
| 350 | Additional heater sensor |
| 351A | Additional heater heater plug |
| 351B | Additional heater heater plug |
| 351C | Additional heater heater plug |
| 352 | Left Side Bag connection |
| 353 | Right Side Bag connection |
| 354 | Air Bag earth |
| 355 | Pretensioners connection |
| 356 | Left Side Bag sensor |
| 357 | Right Side Bag sensor |
| 358 | Left Side Bag |
| 359 | Right Side Bag |
| 362 | Passenger presence sensor |
| 363 | Phase transformer actuator (1998) |
| 364 | Motorized butterfly casing |
| 365 | 4 stage pressure switch |
| 368 | Diode for injection system relay |
| 369 | Engine cooling fan remote control switch |
| 370 | Inertia switch relay (1910 TD-75) |
| 371 | Connector for fault diagnosis |
| 372 | Modular actuator |
| 373 | Air temperature and pressure sensor |
| 374 | Power assisted steering pump sensor |
| N.D. | Ultrasound welding taped in cable loom |

Cable colour code

| | |
|---|---|
| A | Light blue |
| B | White |
| C | Orange |
| G | Yellow |
| H | Grey |
| L | Blue |
| M | Brown |
| N | Black |
| R | Red |
| S | Pink |
| V | Green |
| Z | Purple |
| AB | Light blue - White |
| AG | Light blue - Yellow |
| AN | Light blue - Black |
| AR | Light blue - Red |
| AV | Light blue - Green |
| BG | White - Yellow |
| BL | White - Blue |
| BN | White - Black |
| BR | White - Red |
| BV | White - Green |
| BZ | White - Purple |
| CA | Orange - Light blue |
| CB | Orange - White |
| CN | Orange - Black |
| GN | Yellow - Black |
| GL | Yellow - Blue |
| GR | Yellow - Red |
| GV | Yellow - Green |
| HG | Grey - Yellow |
| HN | Grey - Black |
| HR | Grey - Red |
| LB | Blue - White |
| LG | Blue - Yellow |
| LN | Blue - Black |
| LR | Blue - Red |
| LV | Blue - Green |
| MB | Brown - White |
| NZ | Black - Purple |
| RB | Red - White |
| RG | Red - Yellow |
| RN | Red - Black |
| RV | Red - Green |
| SN | Pink - Black |
| VB | Green - White |
| VN | Green - Black |
| VR | Green - Red |
| MN | Brown - Black |
| HV | Grey - Green |
| ZB | Purple - White |

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page

## AIR BAG - NEW FEATURES

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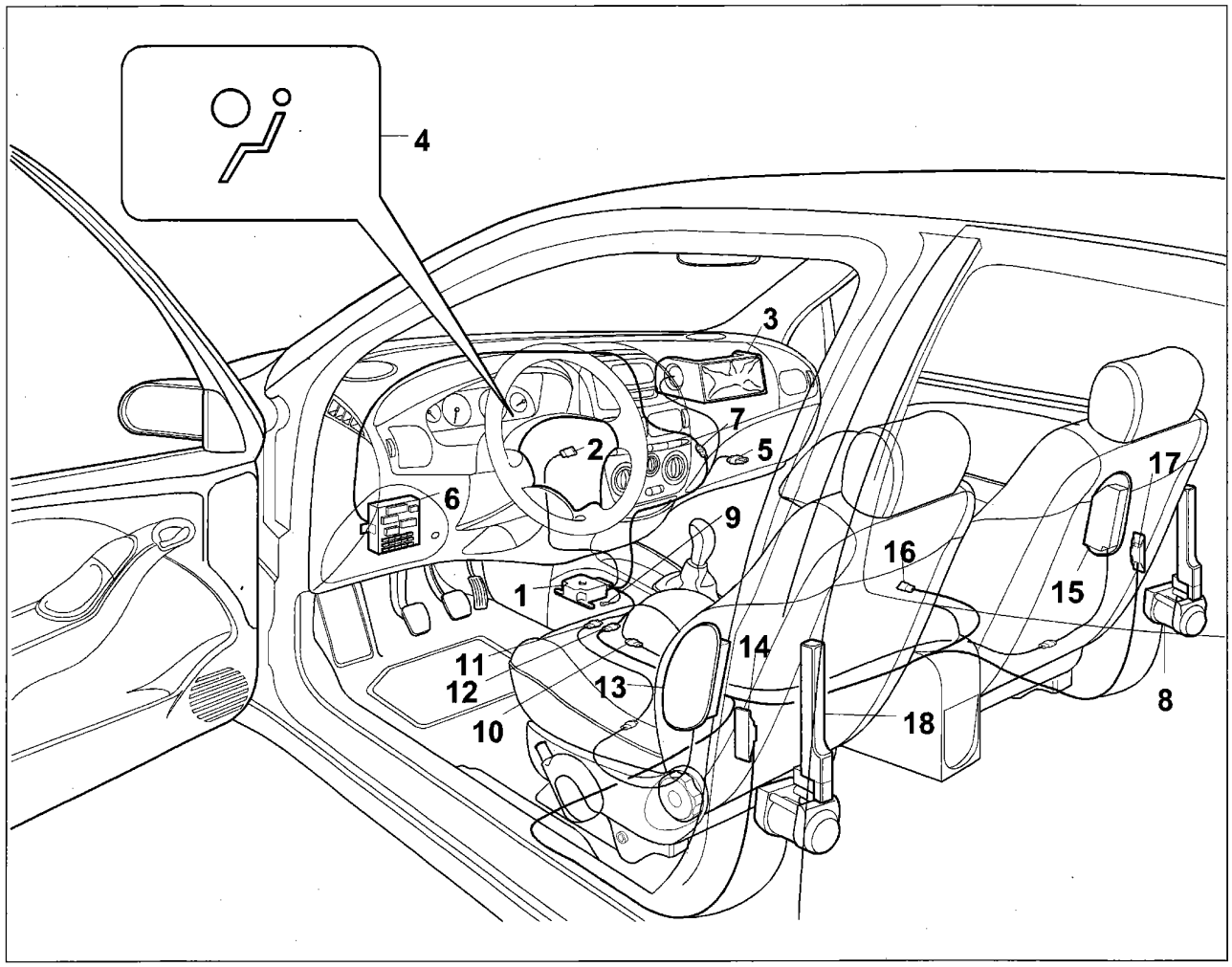
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## INTRODUCTION

The 1999 Fiat Marea - Marea Weekend range is fitted with a new Air Bag system. This differs from the current system in the addition of a passenger presence sensor PPD on the front seat. This allows the passenger side air bag and pretensioner to go off only if the seat is occupied.
The standard system may also optionally be fitted with a side impact prevention system known as a side bag.

Location of air bag and side bag system components on the car.




4F0001FL01

1. Air bag control unit
2. Driver air bag module
3. Passenger air bag module
4. Air bag system failure warning light
5. Tester connection
6. Junction unit
7. Air bag control unit supply junction
8. Passenger side pretensioner
9. Air bag system earth
10. Passenger air bag - side bag control unit junction
11. Driver air bag - side bag control unit junction
12. Air bag - PPD sensor control unit junction
13. Driver side bag module
14. Driver side impact recognition sensor
15. Passenger side bag module
16. Passenger presence sensor (PPD)
17. Passenger side impact recognition sensor
18. Driver side mechanical pretensioner

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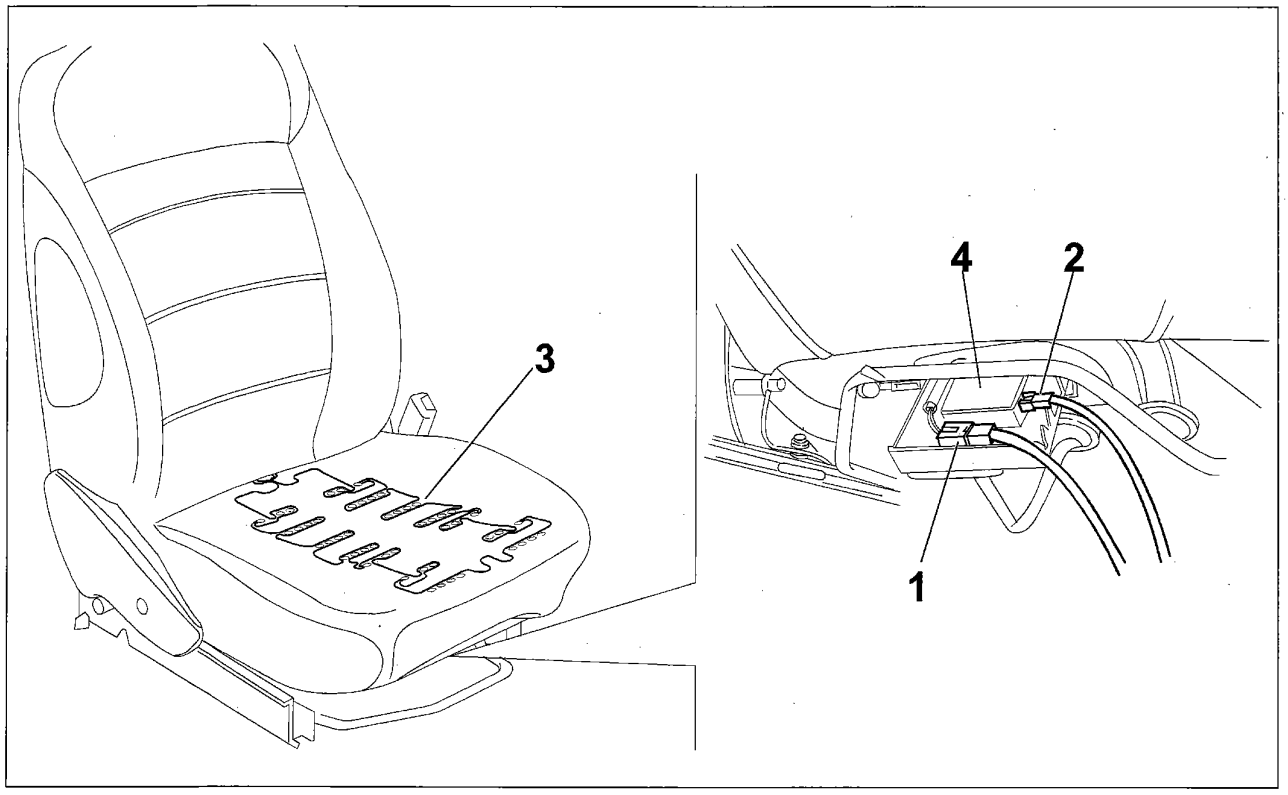

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# 55.

## PASSENGER PRESENCE SENSOR PPD

The 1999 range air bag system now comes with a passenger presence sensor that prevents the front passenger air bag and passenger side bag (where fitted) going off if a passenger is not present.

Passenger side seat with passenger presence sensor (PPD)




4F002FL01

1. Side bag control connector
2. Passenger presence sensor connector
3. Passenger presence sensor PPD
4. Electronic interface device

The Passenger Presence Sensor identifies the presence of a weight on the seat cushion and transmits this information to the electronic control unit that manages the air bag system. The ECU, which also controls the pretensioner, is connected electrically to the system via a cable (with a yellow sheath). The cable connector is located in the lower part of the seat anchored to the bottom on the right side.

If no passenger is present, the control unit disables the front and side bags (where fitted) on the passenger side.

This solution allows a significant reduction in repair costs in the case of accidents where it is not necessary to activate the restraint and protection systems on the passenger side because no occupant is present.

An electronic device located in the lower part of the seat acts as an interface between signals from the control unit and signals from the passenger presence sensor (PPD).



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The sensor consists of a fine, flexible plastic plate that is adhesive on the side in contact with the seat padding and contains an electrical circuit that controls its operation. The plate covers the entire seat cushion area except the two sides. It fits between the padding and trim without altering the functional, aesthetic and ergonomic properties of the seat.

A passenger's presence on the seat is therefore detected even if the passener sits incorrectly and regardless of whether the seat belt is worn or not.

The sensor is also designed to be compatible with a seat heater (available as an option). If a heater is present, the sensor is located underneath it.

The system is adjusted to detect a weight of at least 12 kg under all service conditions (from -35 to +70°C). For lower weights, the reponse depend on service conditions (temperature, shape and position of the weight, trim type, presence or absence of a heater.

The passenger presence sensor and its branch of wiring are monitored continually during car use. The diagnostic function checks for short-circuits or open circuits.

In the case of sensor malfunction, sensor readings are ignored and the system behaves in the same way as a conventional system, maintaining the passenger front and side bags active. The red failure warning light stays on.

## ELECTRONIC CONTROL UNIT FOR AIR BAG SYSTEM AND PASSENGER PRESENCE SENSOR (PPD)

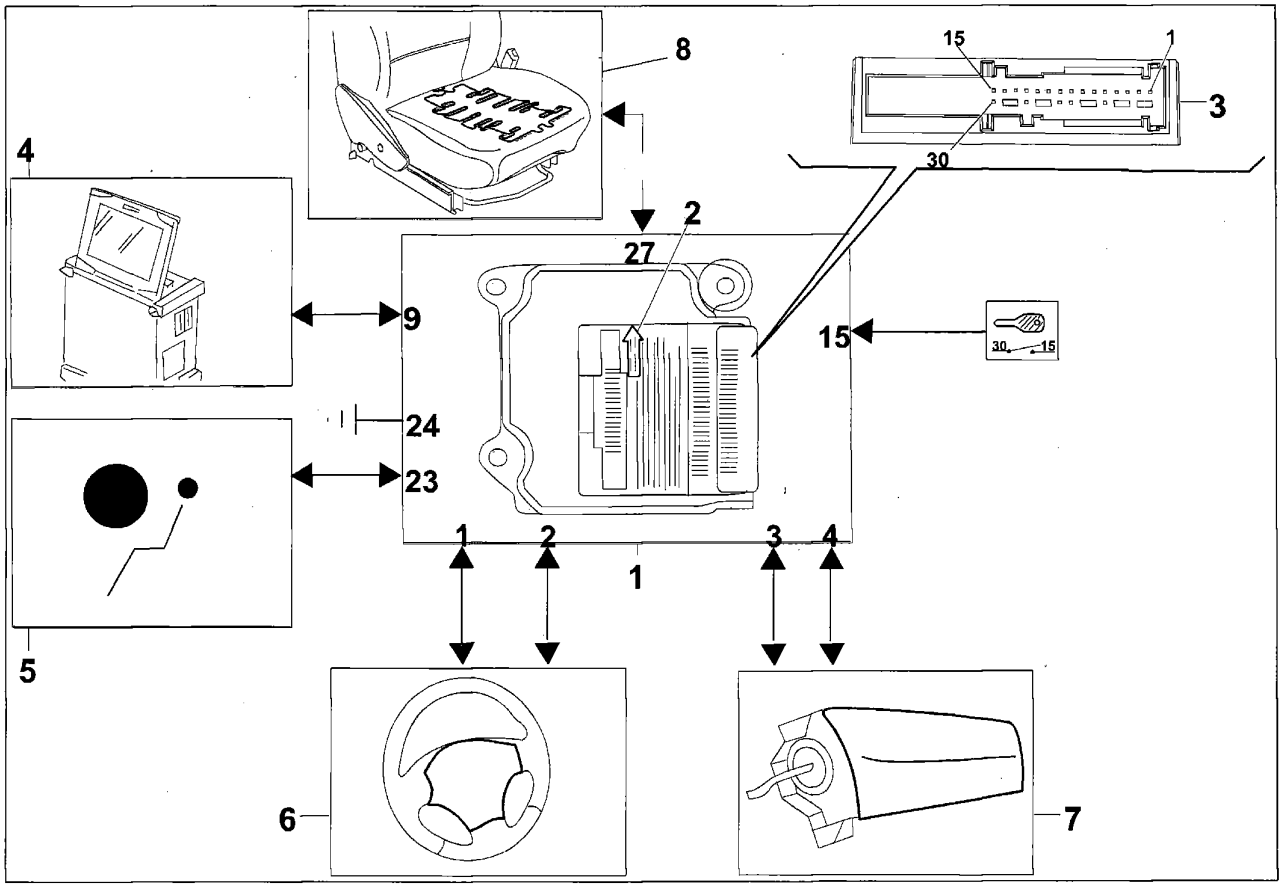
The air bag system fitted to the 1999 range Fiat Marea-Marea Weekend comes with a new electronic control that differs from the previous system in the addition of a connection to the passenger presence sensor and the integration of control functions.

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# 55.

**Diagram showing connections between control unit and components**




1. Electronic control unit
2. Arrow showing control unit installation direction
3. 30 pin connection (see PIN OUT)
4. Tester
5. System failure warning light
   Air bag
6. Driver air bag module
7. Passenger air bag module
8. Passenger presence sensor (PPD)

### Control unit pin out

1. Driver air bag
2. Driver air bag
3. Passenger air bag
4. Passenger air bag
5. Available
6. Not connected
7. Not connected
8. Available
9. Serial line (K) for testers
10. Not connected
11. Not connected
12. Available
13. Not connected
14. Not connected
15. Ignition-operated power supply (+15)
16. Short circuit
17. Short circuit
18. Short circuit
19. Short circuit
20. Not connected
21. Short circuit
22. Short circuit
23. Air bag system failure warning light
24. Earth
25. Short circuit
26. Short circuit
27. Passenger presence sensor
28. Short circuit
29. Short circuit
30. Electronic wiring recognition input




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## SYSTEM WITH SIDE BAG

The side impact protection system, or side bag, fitted as an option on the car, extends the system already present on the car and offers maximum protection to front seat passengers by protecting critical body areas.
The side bag system is controlled integrally with the two front air bags by a control unit that reads and processes deceleration and impact data from two sensors located in the car's side pillars.

The system consists of:
- control unit (50 pin)
- side bag modules within the front seat squabs, on the side facing the outside of the car;
- side deceleration sensors.

## CONTROL UNIT FOR AIR BAG, SIDE BAG AND PASSENGER PRESENCE SENSOR (PPD) SYSTEM

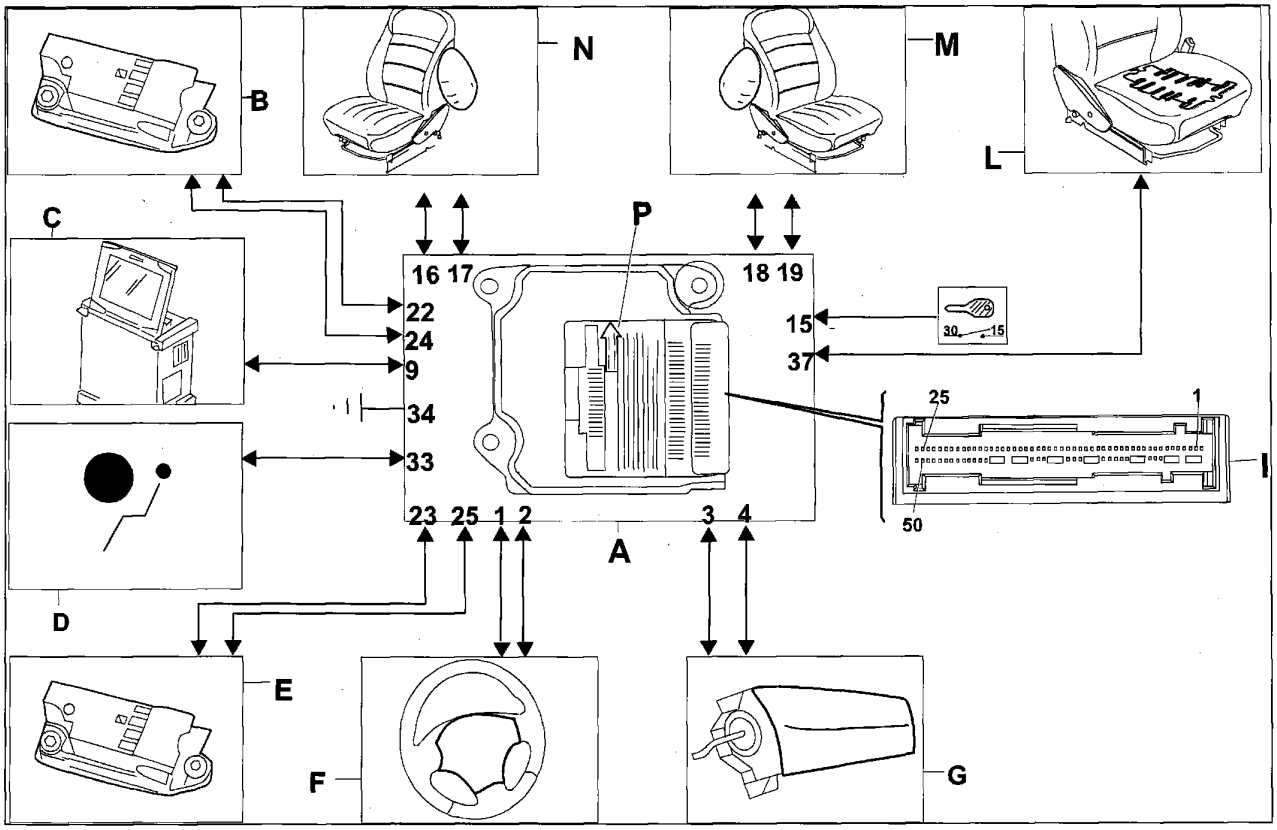
The control unit for the system with side bag differs from the unit used with the system made up of driver air bag, passenger air bag, pretensioners and passenger presence sensor because it is able to process data sent by satellite side sensors and features a different pin out: the control unit is connected to the system via a 50-pin connection.
The system with side bags operates in the same way as the system with front air bags.The control unit is calibrated in accordance with specific activation thresholds that ensure the unit operates only in the case of impacts where the occupant requires additional protection. It is able to differentiate between these impacts and other events where operation is not necessary (low-energy side impact, blows against the side not caused by other vehicles, etc.).
The control unit is programmed to deactivate the front air bag, the side bag module on the passenger side and the associated pretensioner if the presence sensor detects the continual absence of a passenger for at least 30 seconds, and to reactivate them immediately as soon as a passenger presence is detected.
In the case of an air bag system with side bag, the wiring branch is monitored continuously by the control unit while the car is in use. If an anomaly is detected, the red failure warning light is activated and the system operates in conventional manner to keep the driver and passenger side air bags operational at all times.

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# 55.

Diagram showing connections between control unit and components




Control unit pin out

1. Driver's air bag
2. Driver's air bag
3. Passenger air bag
4. Passenger air bag
5. Available
6. Not connected
7. Not connected
8. Available
9. Serial interface (K) for tester
10. Not connected
11. Not connected
12. Available
13. Not connected
14. Not connected
15. (+15) ignition-operated power supply
16. Driver's side bag
17. Driver's side bag
18. Passenger side bag
19. Passenger side bag
20. Available
21. Not connected
22. Driver's side bag sensor power supply
23. Passenger side bag sensor power supply
24. Driver's side bag sensor earth
25. Passenger side bag sensor earth
26. Short circuit
27. Short circuit
28. Short circuit
29. Short circuit
30. Not connected
31. Short circuit
32. Short circuit
33. Air bag system failure warning light
34. Earth
35. Short circuit
36. Short circuit
37. Passenger presence sensor
38. Short circuit
39. Short circuit
40. Electrical wiring recognition input
41. Short circuit
42. Short circuit
43. Short circuit
44. Short circuit
45. Not connected
46. Not connected
47. Not connected
48. Not connected
49. Not connected
50. Not connected



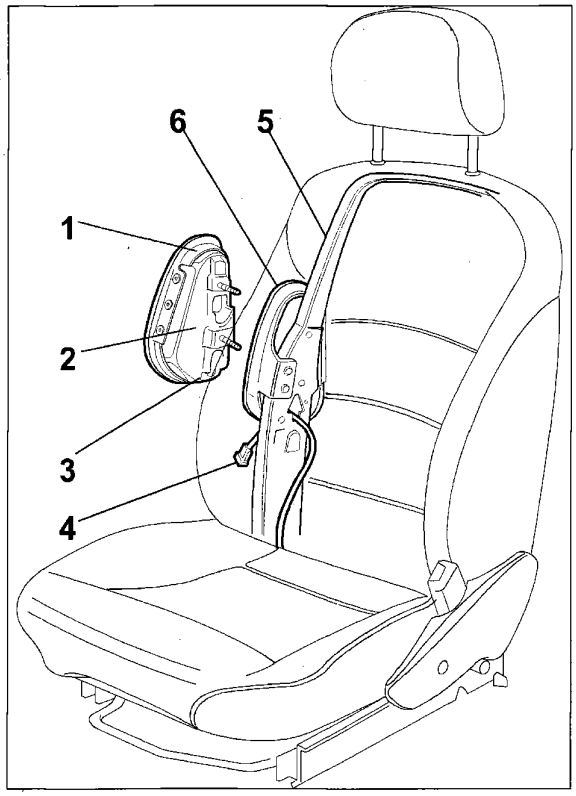

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A. Electronic control unit
B. Driver's side impact recognition sensor
C. Tester
D. Air bag system failure warning light bulb
E. Passenger side impact recognition sensor
F. Driver's air bag module
G. Passenger air bag module
I. 50-pin connector (see pin out)
L. Passenger presence sensor
M. Passenger side bag module
N. Driver's side bag module
P. Arrow indicating control unit installation direction

## SIDE BAG MODULES

The side bag modules fitted to the Fiat Marea - Marea Weekend are fitted by a bracket to the inside of the squab on the side facing the outside of the structure. This is an improvement on the version where the modules are fitted to the door because the bag is always in optimal position in relation to the occupant regardless of seat position or occupant size.
The side bag modules consist mainly of:
- a bag measuring about 12 litres in volume and made out of permeable cloth that is able to protect the outer area of the chest and abdomen;
- a metal case containing a pyrotechnic charge that, when activated by an electric signal, causes gas to emerge and inflate the bag.
- an extremely light, plastic containment cover for the bag that maintains squab size and appearance while ensuring the bag emerges easily;
- bracket securing the module to the seat structure.

Side bag module



P4A07JL01

1. Copertura in plastica
2. Scatola metallica
3. Connettore del modulo Side bag
4. Cavo elettrico di attivazione
5. Struttura schienale
6. Vano modulo Side bag

The side bag modules are fitted to the seat trim and do not alter the style or size of the original seat significantly.
A plastic cover in the seat trim over the module opens to allow the bag to inflate.



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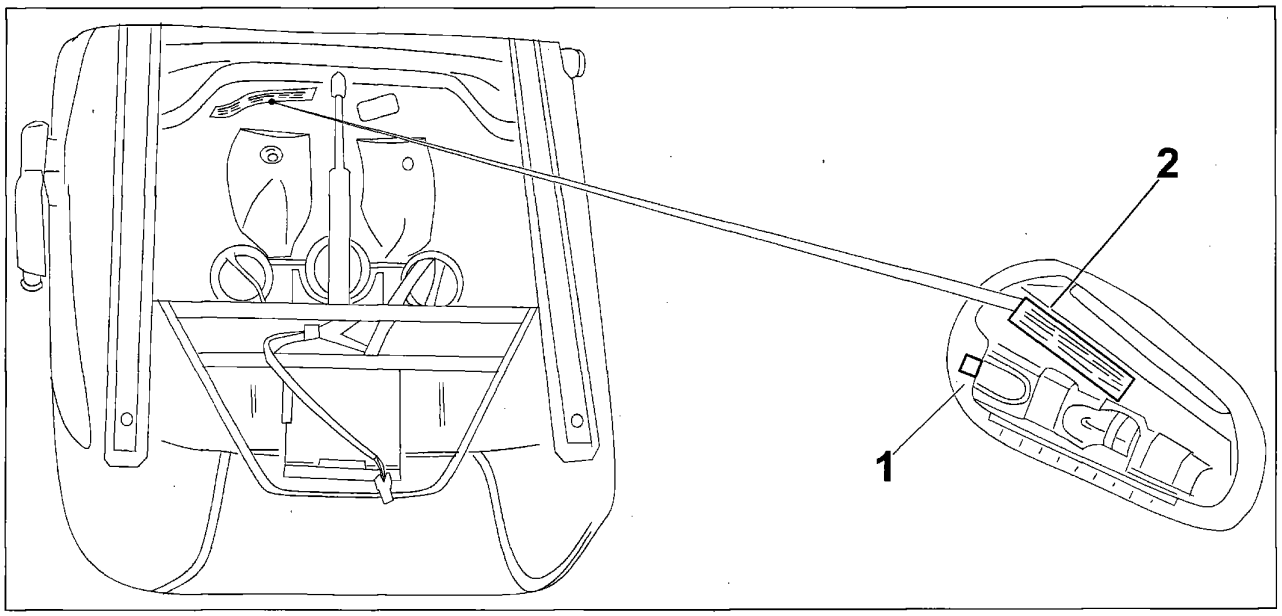
# 55.

## GENERAL WARNINGS

*IT IS ABSOLUTELY FORBIDDEN to use any type of seat cover that is not specifically designed for this type of seat. When replacing, take the greatest care to install in the correct position: the wording SIDE BAG must be on the same side of the squab as the side bag module.*

*Before disconnecting the seat connections to the air bag system (leads with yellow sheath), disconnect both battery terminals, take them out carefully and WAIT AT LEAST 10 MINUTES.*
*Whenever working on the air bag system, it is OBLIGATORY to check system function using special test equipment at the end of the procedure.*

*It is STRICTLY NECESSARY to observe the contents of identification and warning plates on the side bag module whenever the module is handled.*
*When replacing the module, take off the removable label (1) on the new module and apply it to the front part of the seat structure at more or less the point indicated in the following figure so that it is legible with the seat fitted. Also record the serial number in the special log.*
*If the seat structure is to be replaced and the side bag module transferred, the above label must be transferred from the old to the new structure.*




P4A08JL01

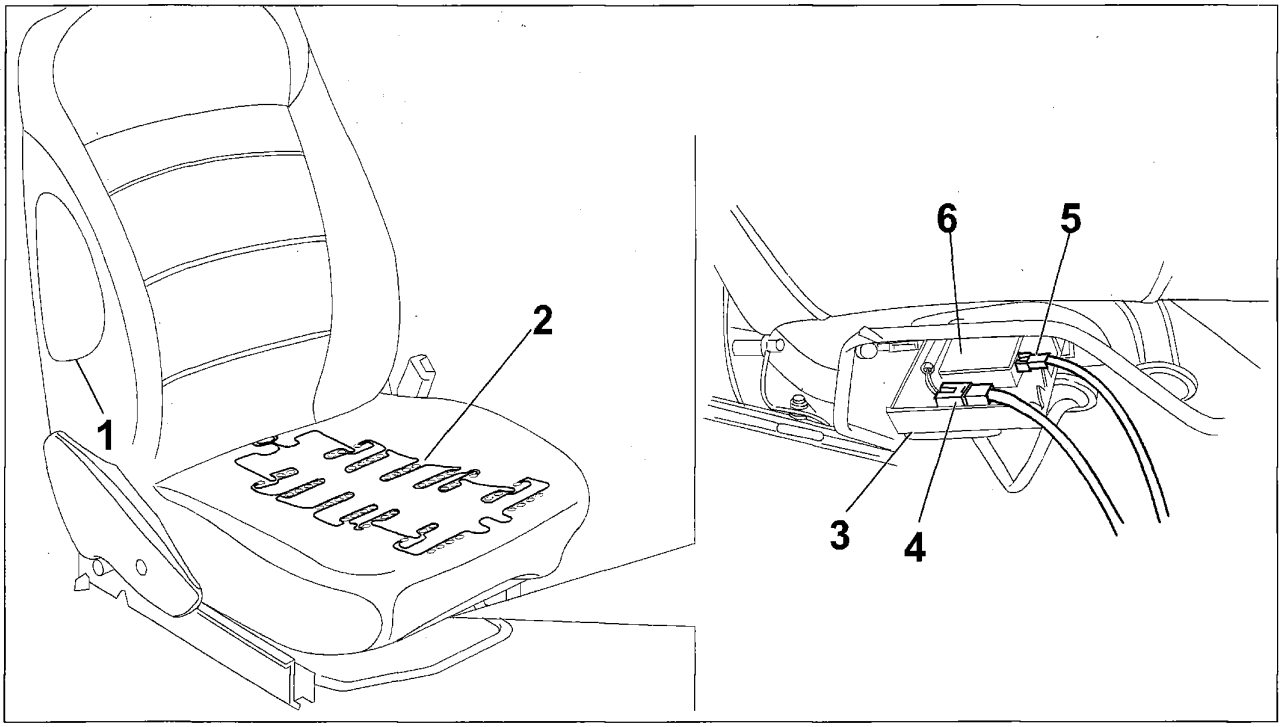
1. New side bag module
2. Removable self-adhesive plate



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The connection points between the side bag module, air bag system and passenger presence sensor (leads with yellow sheath) are located on the bottom of the seat at the front inside a protective box.
The side bag module and passenger presence sensor connections are anchored in a box secured beneath the passenger seat.
When necessary to carry out checks on the system or remove the seat to gain access to the connections located inside the box, open the cover by undoing the retaining clips and prising up the box safety cap (see **Removing-Refitting** front seat with passener presence detector and side bag).

**Seat with side bag and passenger presence sensor (PPD)**




4F009FL01

1. **Side bag module**
2. Passenger presence sensor (PPD)
3. Box protecting connections
4. **Side bag module connection**
5. Passenger presence sensor connection (PPD)
6. **Electronic interface device**

An electronic device located in the lower part of the seat acts as an interface between signals from the control unit and signals from the passenger presence sensor (**PPD**).

## DECELERATION SENSORS

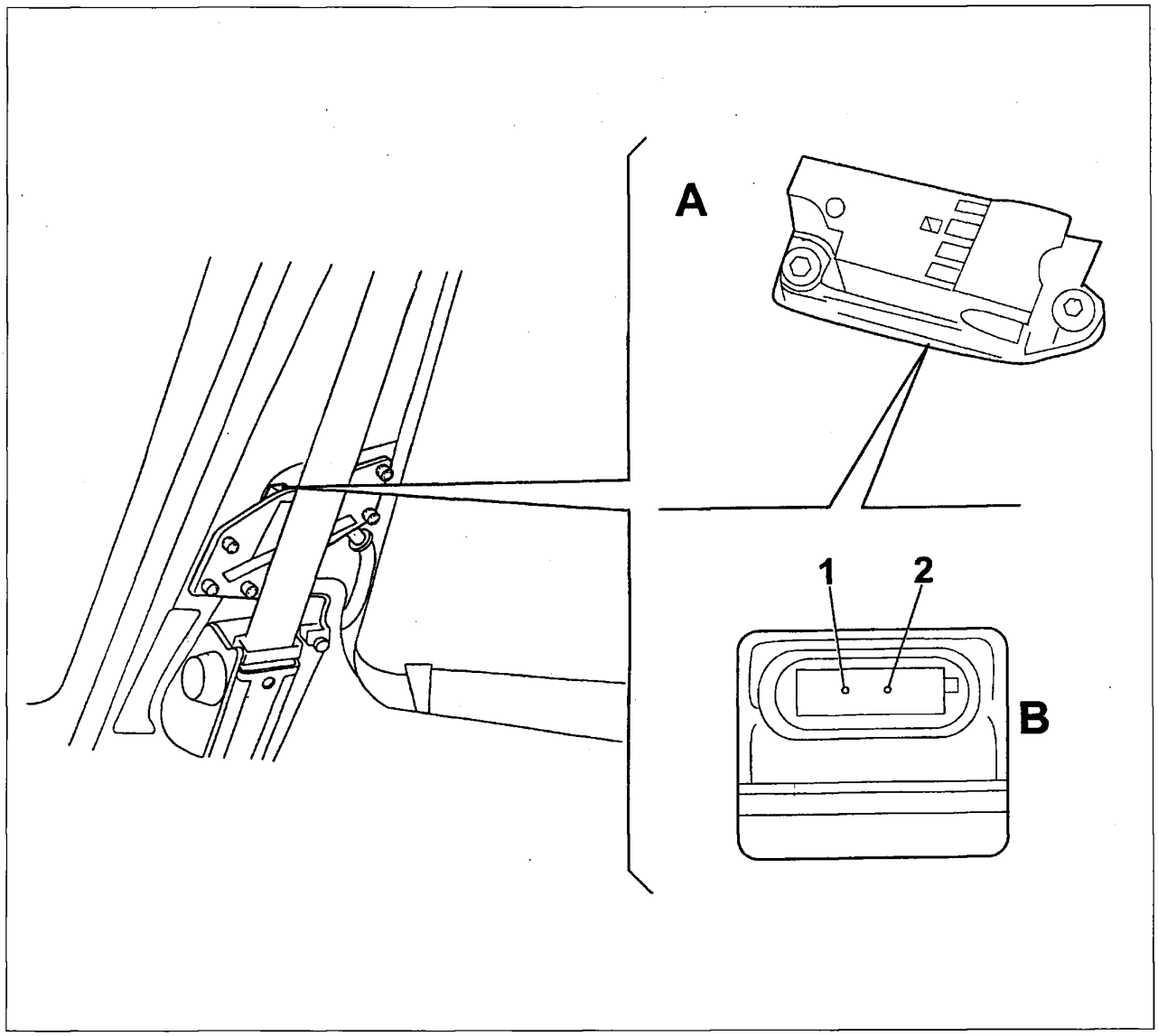
The deceleration sensors are secured to the central car pillars and contain an accelerometer that can detect acceleration that takes place during side impact.
If the impact exceeds a set severity level, the information is transferred from the relevant sensor to the main air bag system control unit, which compares the information with input from a second acclerometer inside the control unit itself, which guarantees a safety function.
If the acclerometric signals detected by the satellite sensor and the control unit agree with one another, the main control unit sets off the side bag module on the side affected by impact.
If the impact is on the passenger side, the main control unit compares the signal from the deceleration sensor with a signal from the passenger presence sensor to determine whether or not to set off the side bag module.



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# 55.

Location of deceleration sensors




A. Deceleration sensor
B. Pin out 1. Side bag sensor power supply
2. Side bag sensor earth

## SAFETY RULES TO BE OBSERVED WHEN WORKING ON CARS FITTED WITH AIR BAG - SIDE BAG SYSTEMS

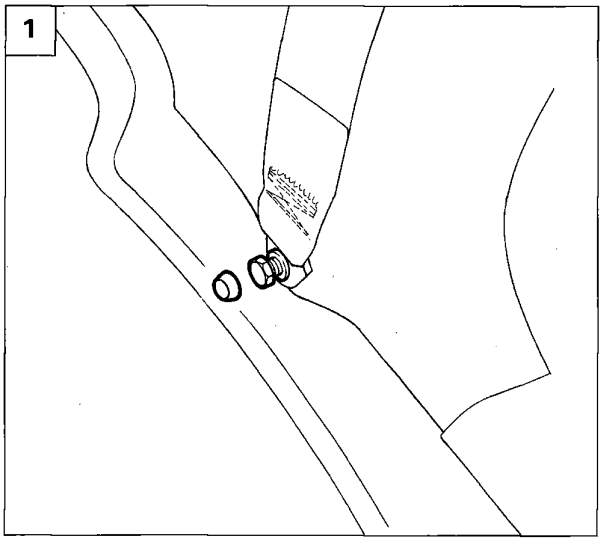
*The following rules MUST BE ADHERED TO when carrying out any operations on cars equipped with an air bag/side bag system.*

System components must be assembled and disassembled ONLY by authorised technical personnel, remembering that the components need handling with care. Component shipping and storage is governed by the handling procedures described in Section 55 - Electrical Equipment of the Fiat Marea - Marea Weekend Workshop Manual (volume 2).

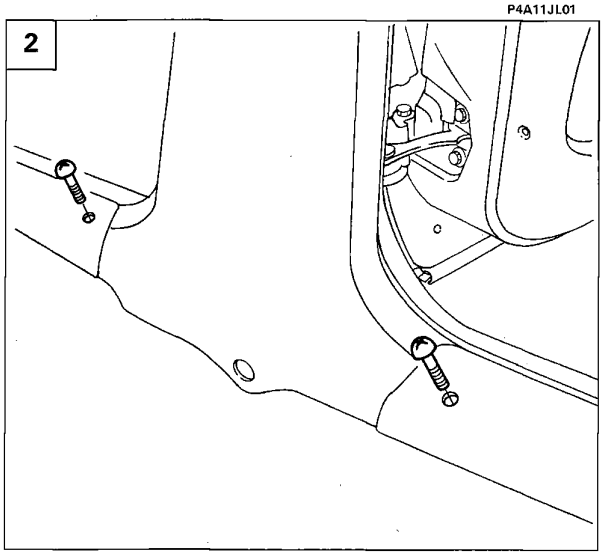


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## REMOVING-REFITTING DECELERATION SENSOR



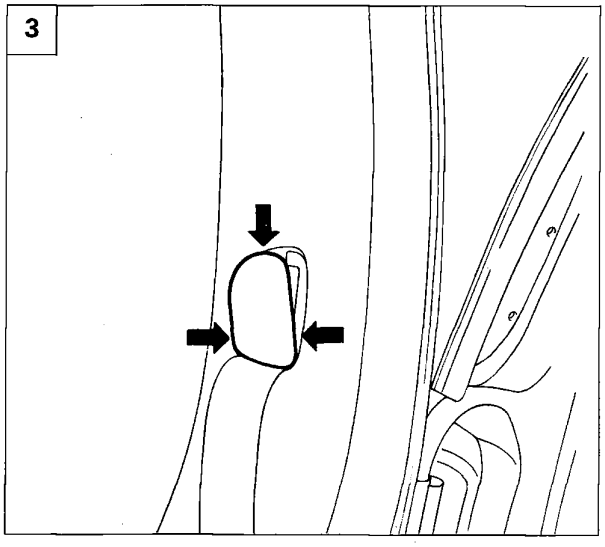

P4A11JL01



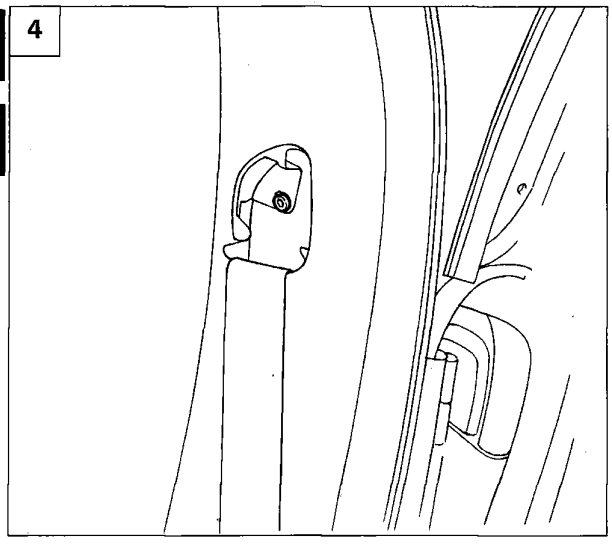

P4A11JL02

*Turn the ignition key to STOP position and remove. Then disconnect the battery.*

1. Prise up the fastener cover and unscrew the bolt securing the front seat belt.
2. Undo the sill plate bolts shown in the figure.
3. Undo the retaining tabs and remove the pillar trim bolt cover plate.
4. Undo the bolt securing the pillar trim.




P4A11JL03

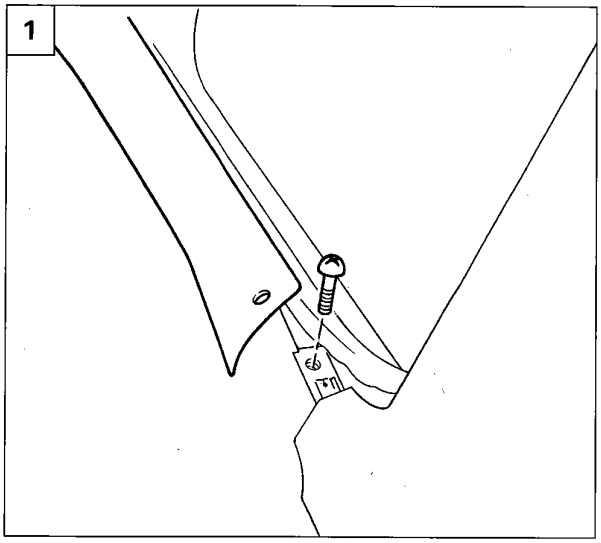



P4A11JL04

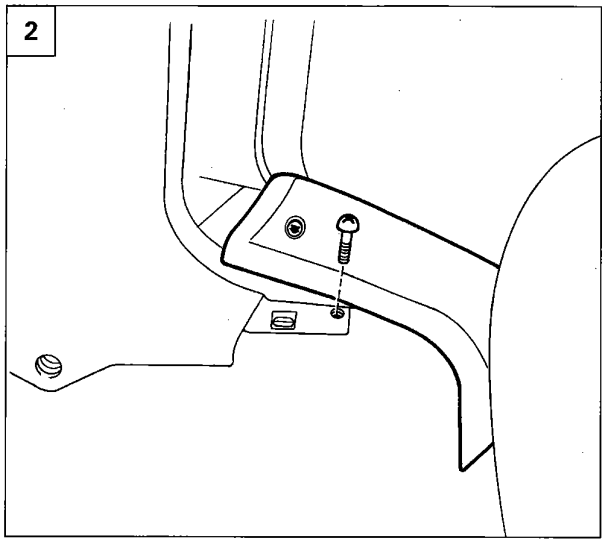


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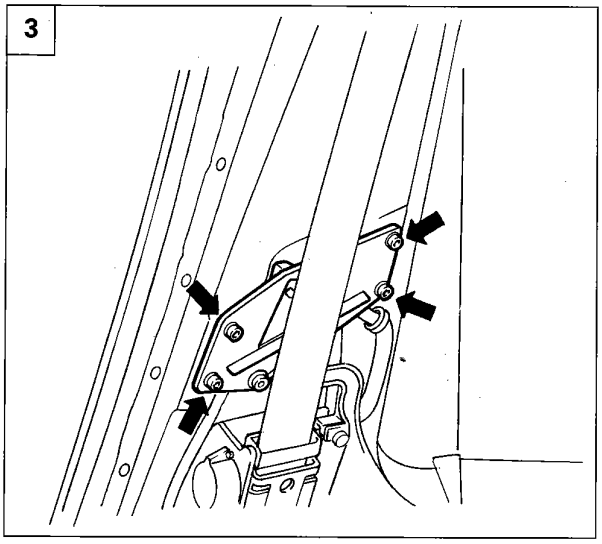
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P4A12JL01

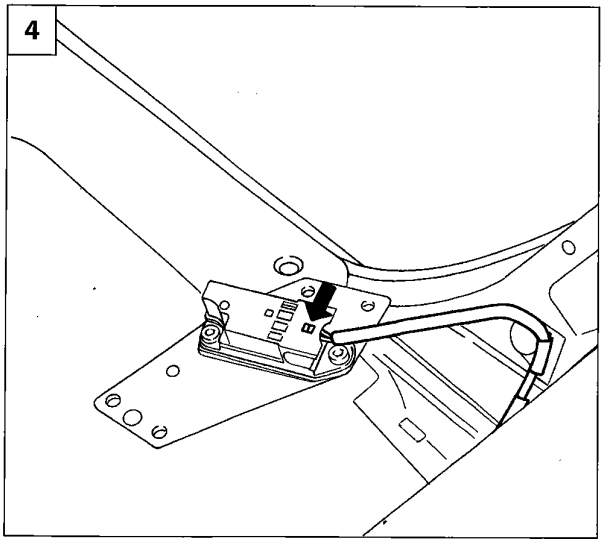



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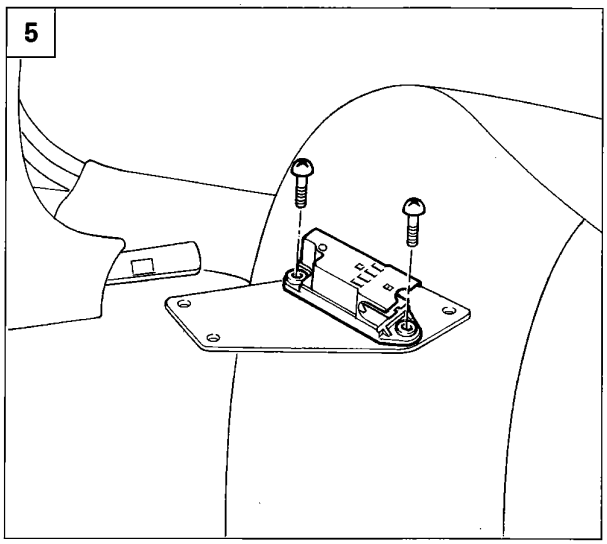



P4A12JL03

1. Raise the rear sill plate, then undo the underlying bolt securing the pillar trim.
2. Raise the front sill plate, then unscrew the underlying bolt securing the pillar trim.
3. Raise the pillar trim, then unscrew the bolts securing the side bag deceleration sensor support bracket.
4. Undo the electrical connection shown in the figure
5. Undo the bolts shown in the figure, then remove the deceleration sensor from its bracket.




P4A12JL04

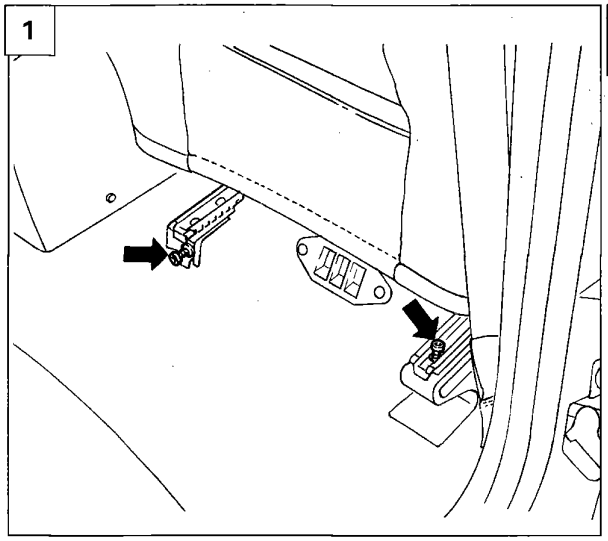



P4A12JL05



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## REMOVING-REFITTING FRONT SEAT WITH PASSENGER PRESENCE SENSOR AND SIDE BAG



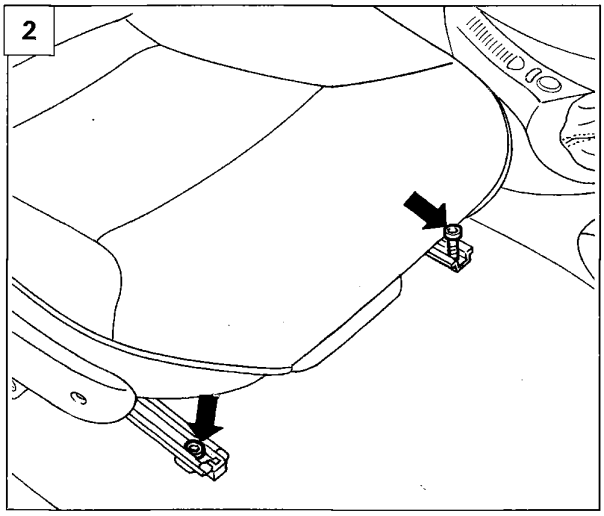

P4A13JL01

### Removing

1. Move the seat forward to the end of its travel and undo the bolts securing the guides to the floor.
2. Move the seat back to the end of its travel and undo the bolts securing the guides to the floor.

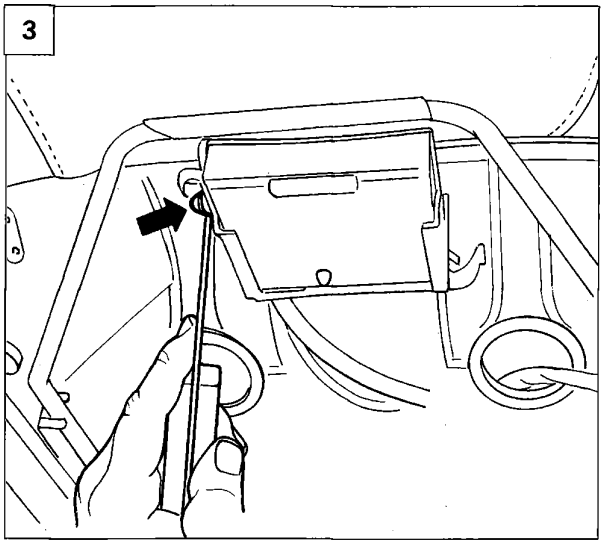
*Before removing the seat.*

- *disconnect the battery terminals;*
- *wait at least 10 minutes before disconnecting the passenger presence sensor connections, then proceed as follows.*

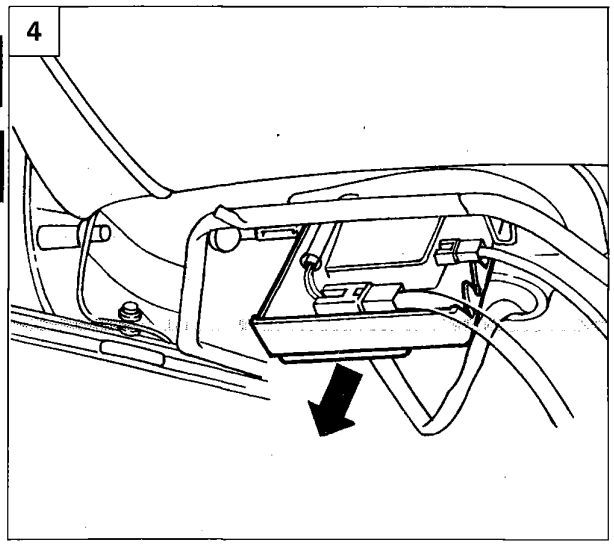



P4A13JL02

3. Tilt the seat back to gain access to the connections, then disconnect the lumbar adjustment connector, heat pad and seat belt, if present. Prise up the connector holder box safety cap.
4. Remove the connection holder box flap.




P4A13JL03

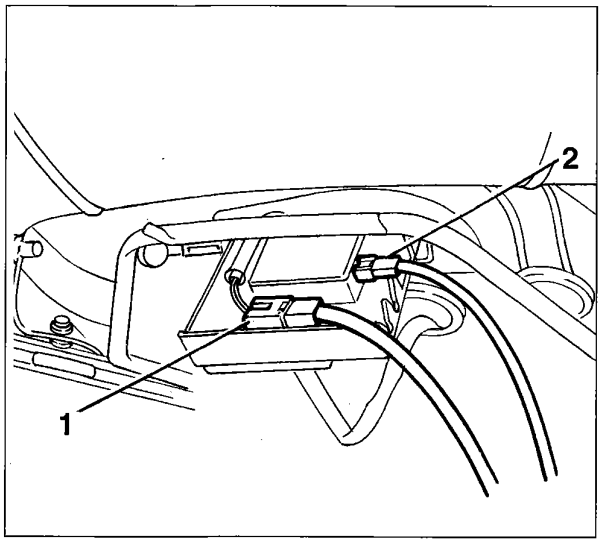



P4A13JL04



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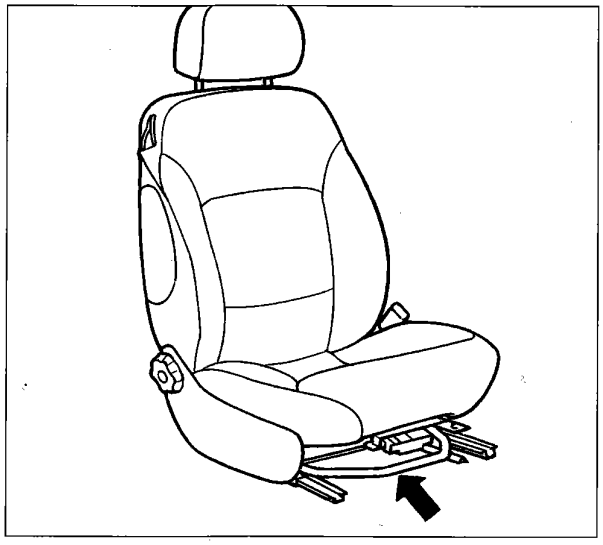
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P4A14JL01

*Two connections are present on the passenger side seat (side bag and passenger presence sensor), while only the side bag connection is present on the driver's seat.*

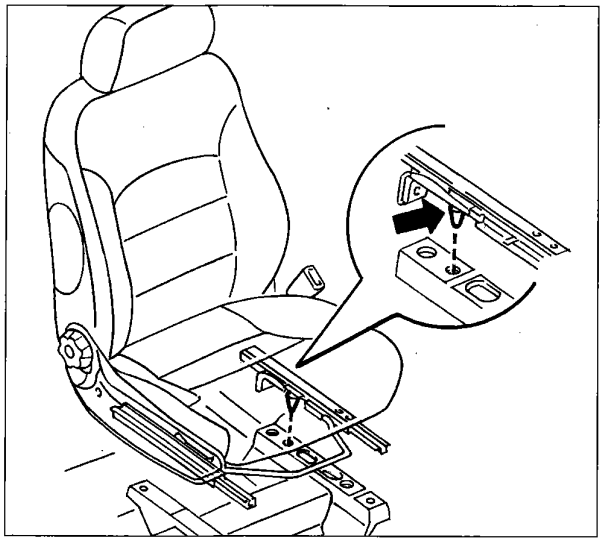
- Disconect connector (1) controlling the side bag and connector (2) controlling the presence sensor;



P4A14JL02

- remove the seat from the car

*Do not remove the seat from its housing using the seat control lever arrowed in the figure or the guides may become misaligned.*



P4A14JL03

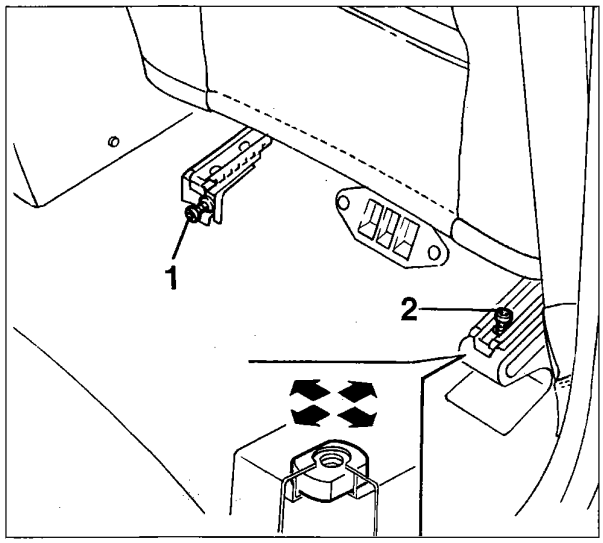
**Refitting**

- Position the seat in the car;
- Connect the electrical connectors leading from the car floor;
- Ensure the locating pin on the seat guides is in the correct position;

*Check that the carpet does not foul against the seat guide contact area.*



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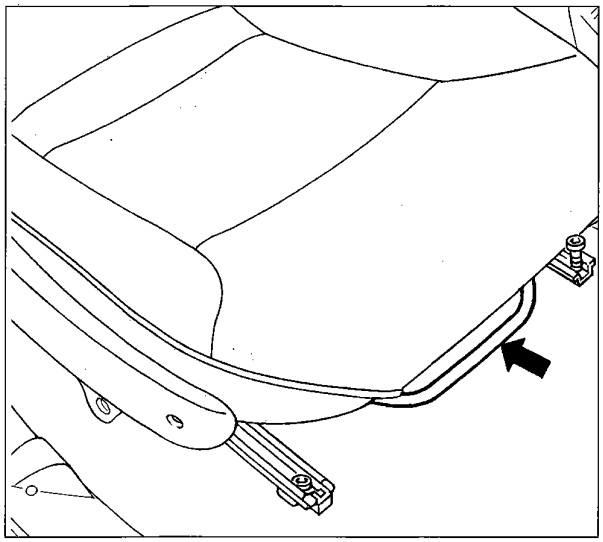



P4A15JL01

- fit and tighten the rear retaining bolts beginning from the inner edge (1) and continuing from the outer edge (2) to the torque of 2.4 daNm.

*The seat must be fastened to the floor without distorting the guide rails. It necessary, adjust the floating nuts shown magnified in the figure and ensure they are free.*

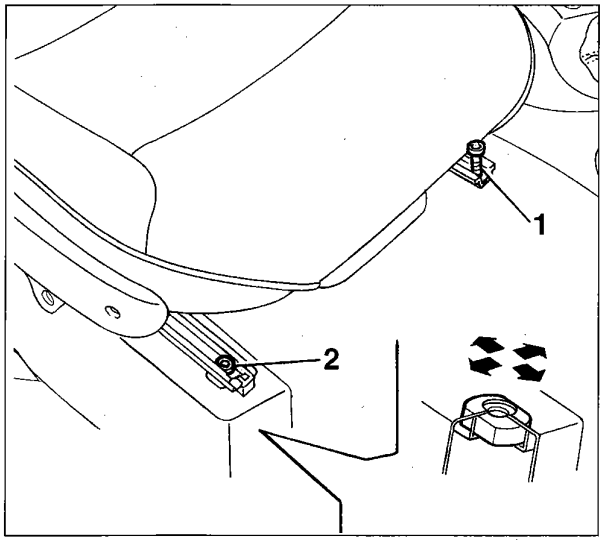
**NOTE** *Do not lift the seat to fit the retaining bolts at this stage.*



P4A15JL02

- move the seat to FULLY BACK position at the end of its travel using the guide control lever;

*Ensure the guide control lever is correctly fitted (clicks into place).*




P4A15JL03

- fit and tighten the front retaining bolts beginning from the inner edge (1) and continuing from the outer edge (2) to the torque of 2.4 daNm.

*The seat must be fastened to the floor without distorting the guide rails. If necessary, adjust the floating nuts shown magnified in the figure and ensure they are free.*

**NOTE** *Whenever work is carried out on the air bag system, it is COMPULSORY to check the system is working properly using the relevant testers.*



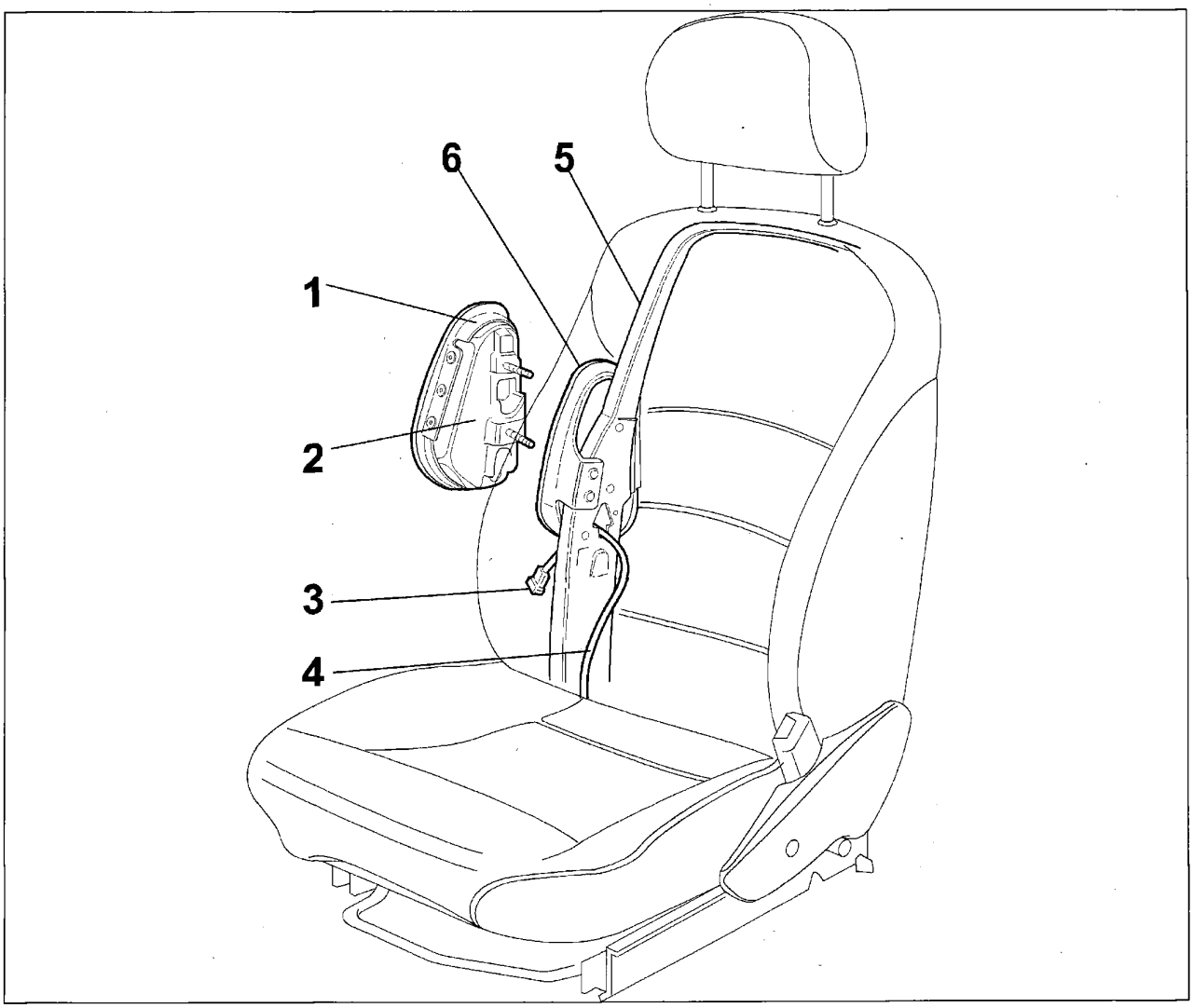
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# 55.

## PERSPECTIVE VIEW OF SIDE BAG

### Dismantling the side bag

Side bag modules are fitted beneath the squab trim and do not significantly alter original seat style and size.



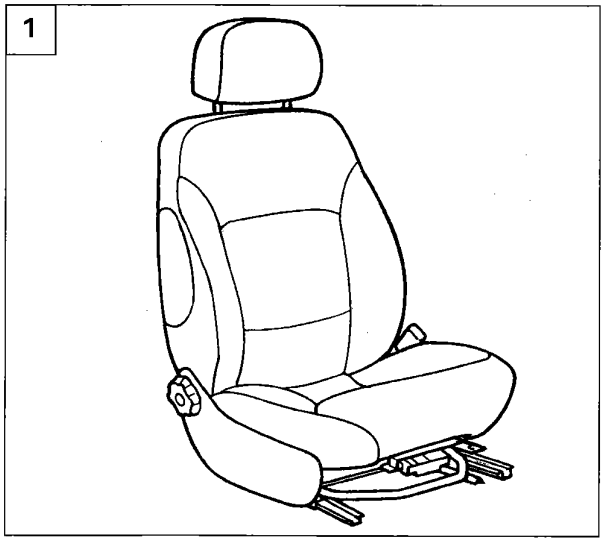

4F016FL01

1. Plastic cover
2. Metal box
3. Side bag module connector
4. Electrical activation lead
5. Squab structure
6. Side bag module compartment



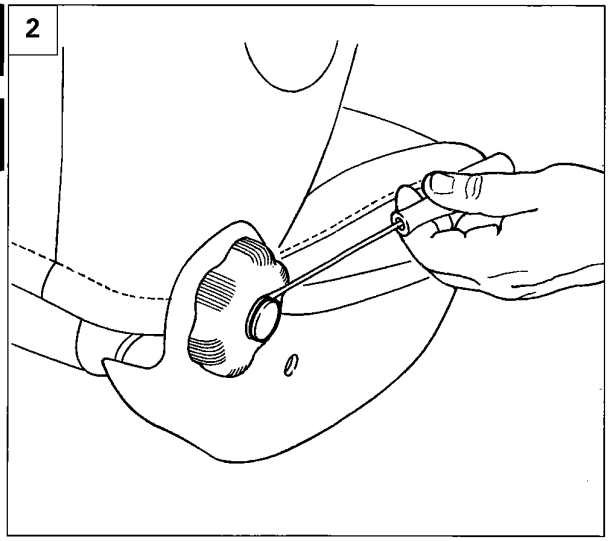
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1



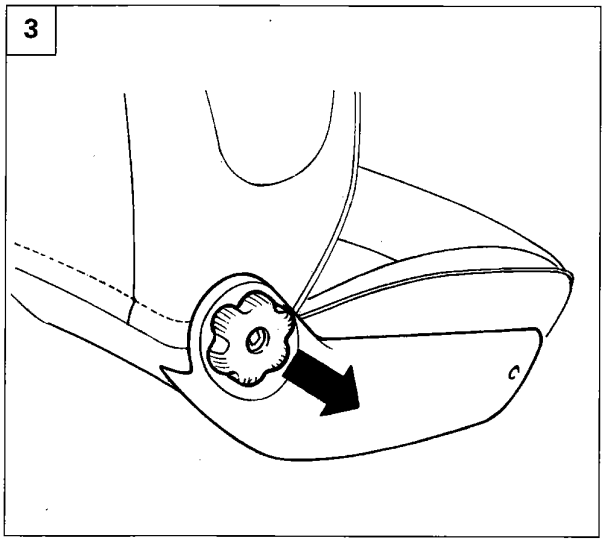
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2



4A17JL02

3

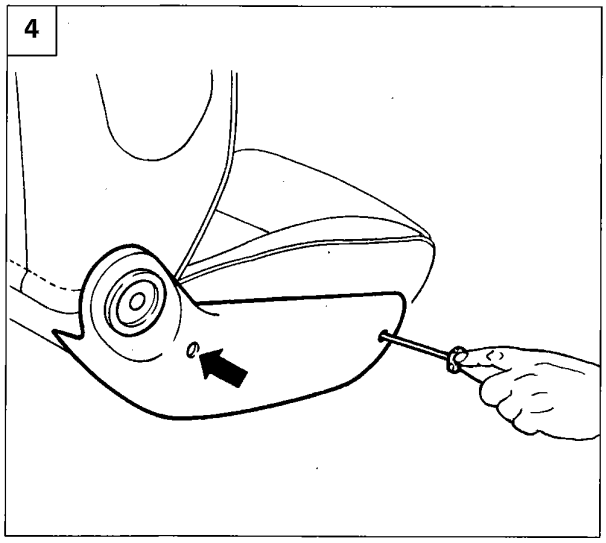


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## REMOVING-REFITTING SIDE BAG MODULE

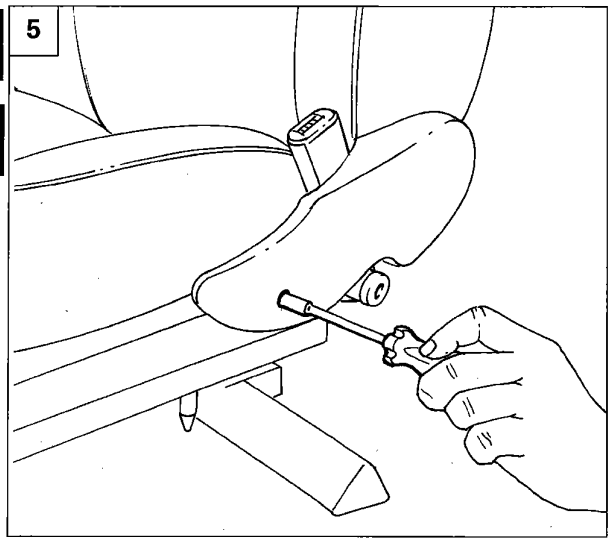
1. Remove the front seat as described in the paragraph "**FRONT SEAT WITH PASSENGER PRESENCE SENSOR AND SIDE BAG**"
2. Prise up the plug securing the seat rake adjustment knob.
3. Remove the seat rake adjustment knob.
4. Unscrew the retaining bolts shown in the figure and remove the outer seat cover.
5. Undo the inner seat cover retaining bolt.

4



4A17JL04

5

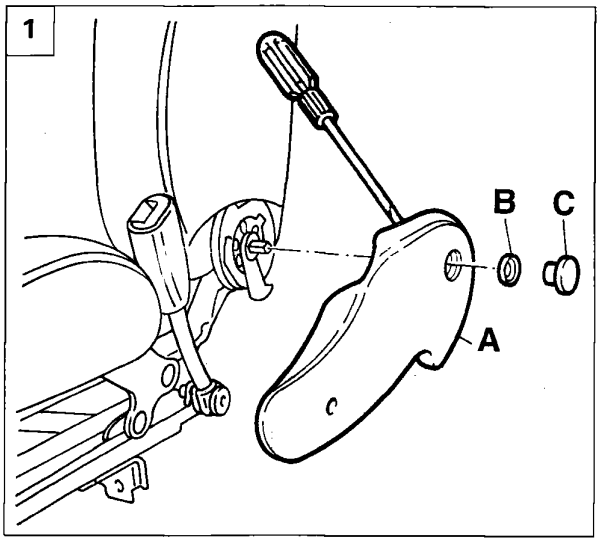


4F017FL05

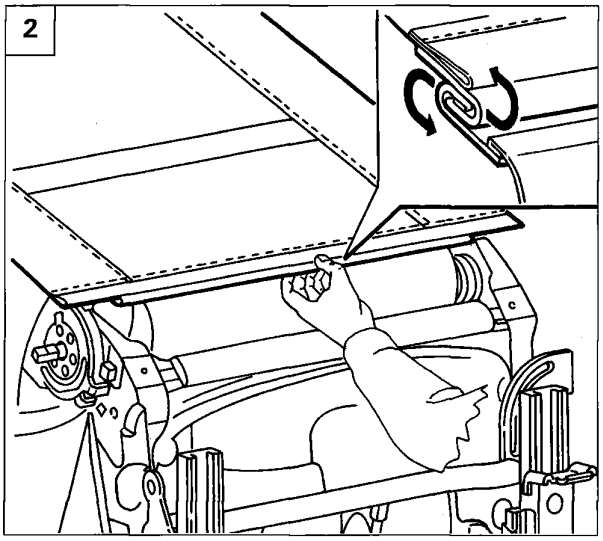


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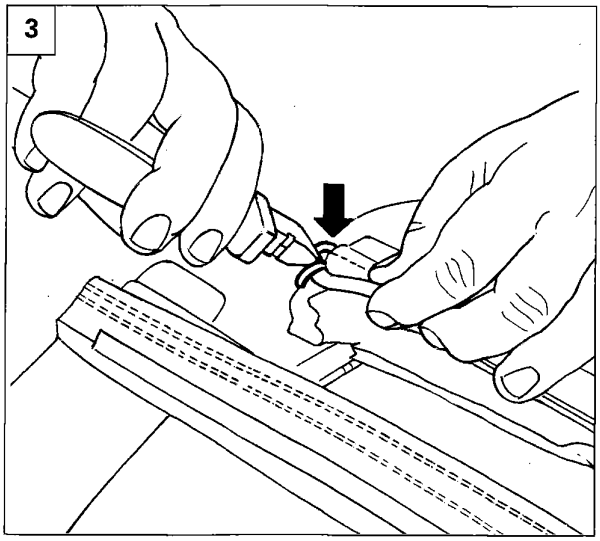
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4F018FL01

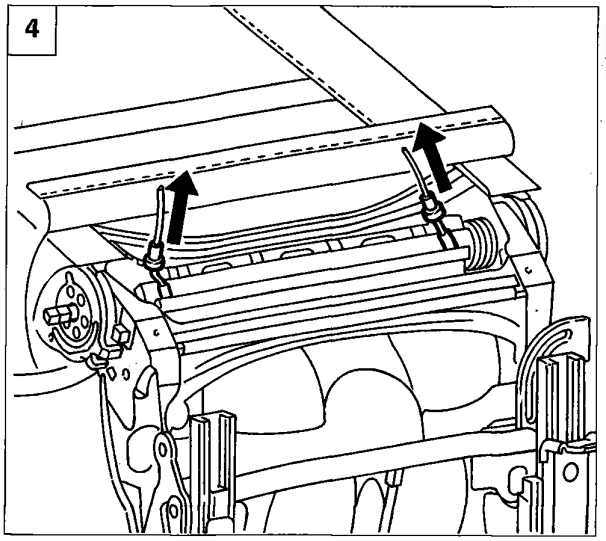



4A022M08

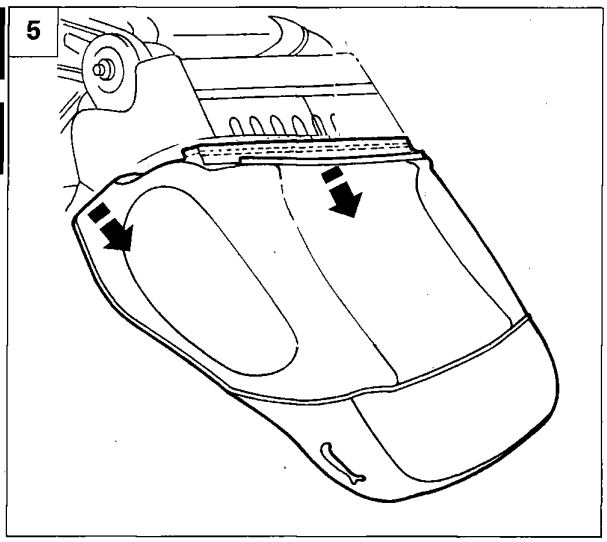



4A18JL03

1. Remove cover A by manoeuvring to release washer B. Take care to avoid breakage. Push plug C from inside after removing the trim. Recover claw washer B.
2. Release the plastic squab section from its retaining system.
3. Undo the hooks (two on each side) securing the cover to the padding using cutting pliers.
4. Disconnect the tensioning links.
5. Withdraw the cover partly to gain acces to the side bag module retaining nuts.



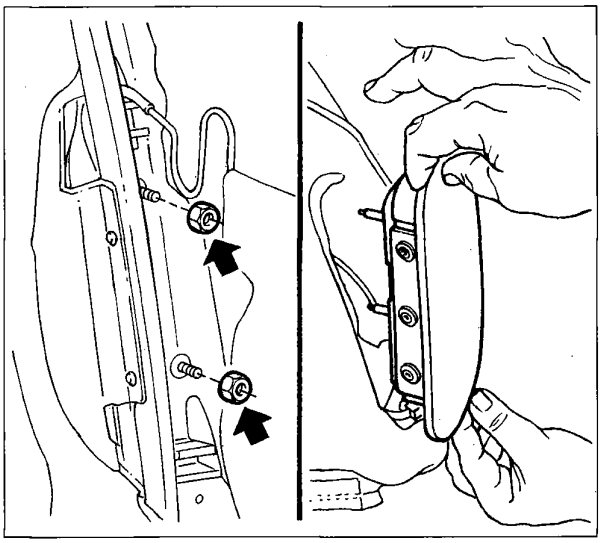

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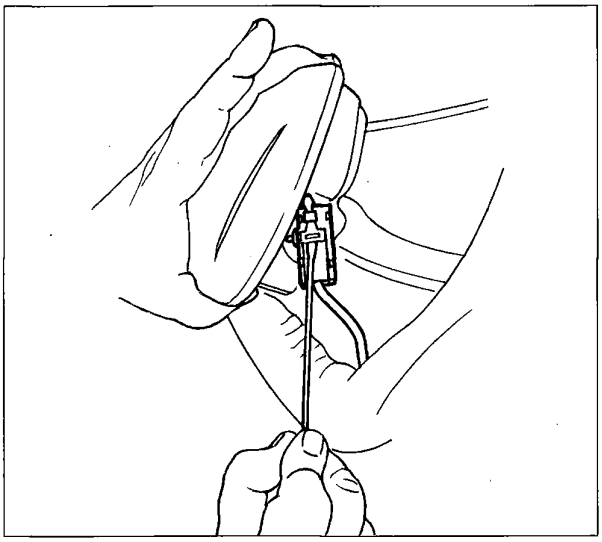



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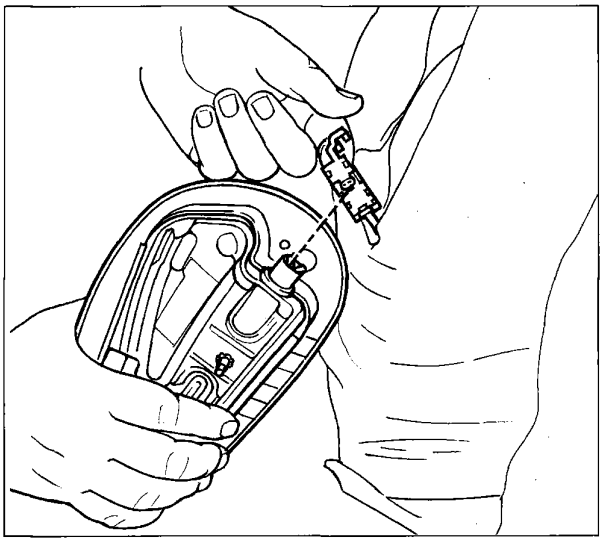
4F019FL01

- Undo nuts (M6) securing the side bag module to the the seat frame, using a 10mm jointed or ratchet hexagonal wrench



4A19JL02

- remove the side bag module from its housing and disconnect the safety connection.



P4A19JL03

*remove the side bag module from its supply lead.*

*Adhere scrupulously to the instructions in the General Warnings chapter when handling the side bag module.*

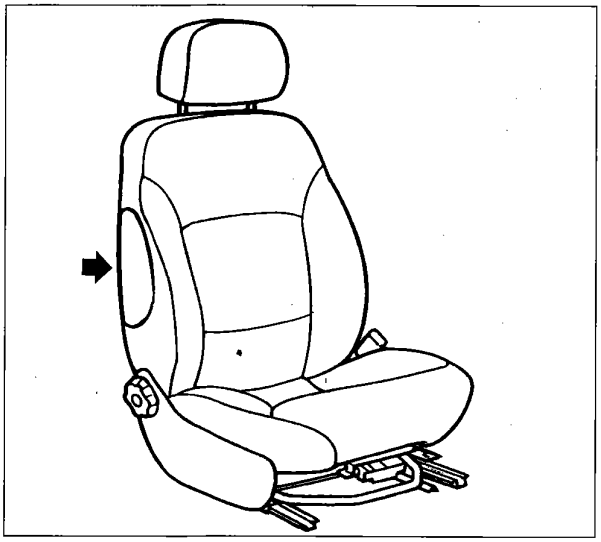
**NOTE** *To refit, reverse removal instructions. Ensure the side bag module safety connector is reconnected in all cases, otherwise the warning light on the instrument facia will come on to indicate a fault.*

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# 55.

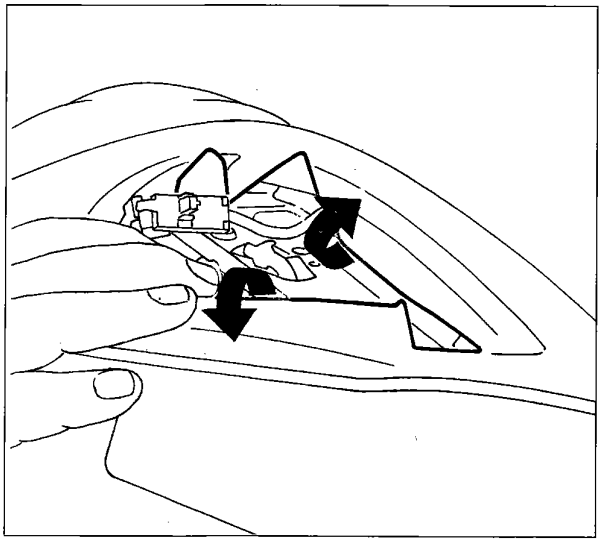


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## REMOVING-REFITTING FRONT SEAT

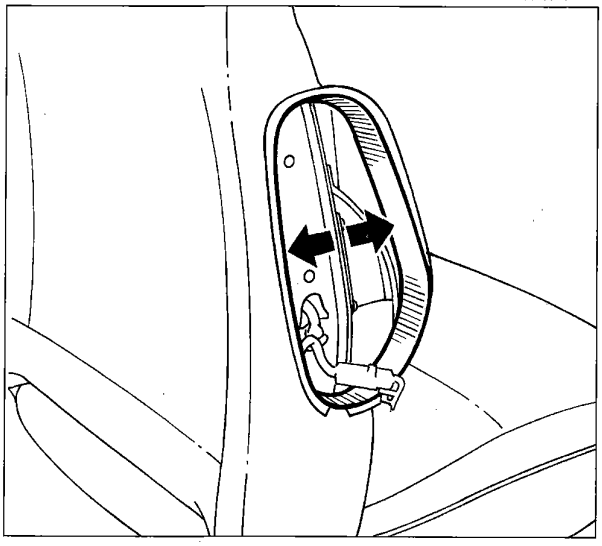
**Removing-refitting front seat squab cover.**

- Remove the side bag module as described in the "SIDE BAG MODULE" chapter.



4A20JL02

- remove the cover in the outer compartment of the side bag from the Velcro;

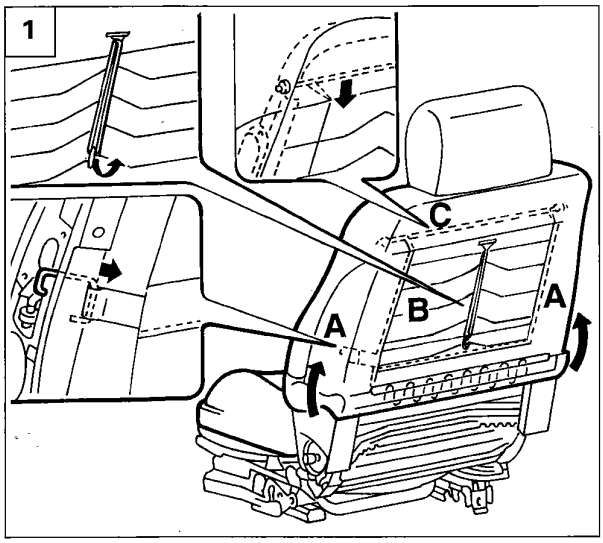


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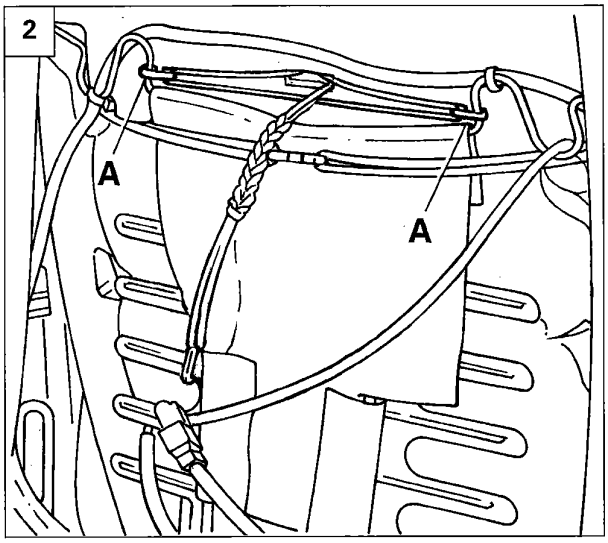
- secure the seat squab cover to the Velcro in the outer side bag compartment as shown in the figure (only during refitting).



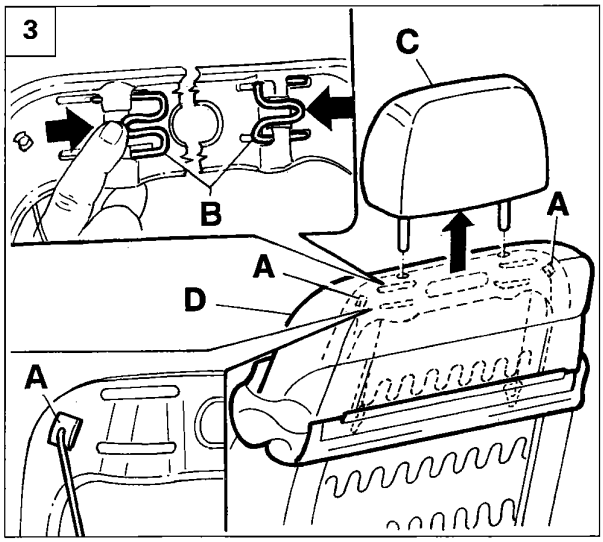
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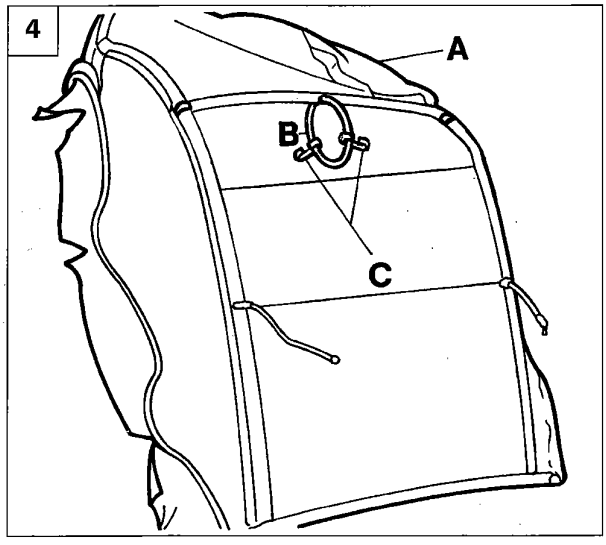



4F021FL02




4F021FL03

1. Withdraw the cover, then undo fastening hooks A. Release the elastic band B and then upper retaining rod C; (operation applies to passenger seat).
2. Release attachments (A) joining the tensioning elastic (operation applies to driver's seat).
3. Release the two links A from the housing as shown in the magnified section, turn spring B. Remove head restraint C, then remove cover D.




4F021FL04

4. View of inside of cover
   A. Cover
   B. Elastic retainer
   C. Retaining hooks

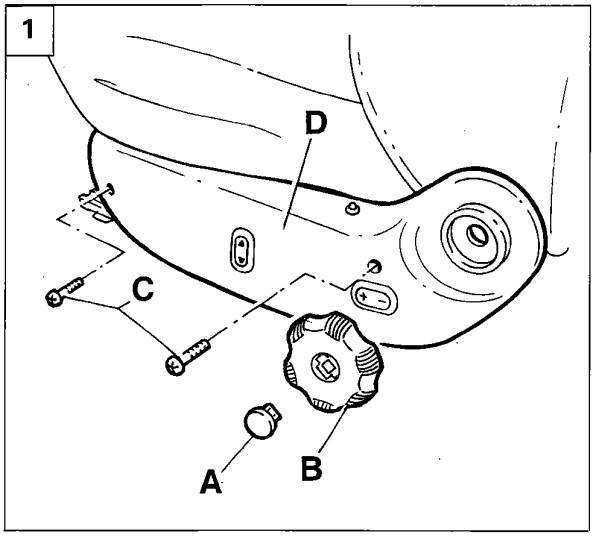
**NOTE** *Reverse removal instructions to refit. Secure the squab cover hooks using tool 1878077000, taking care to do up the links correctly.*

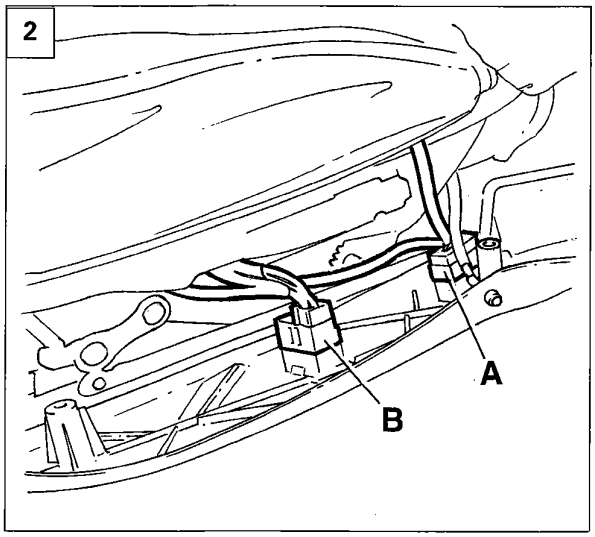
*Use new hooks.*



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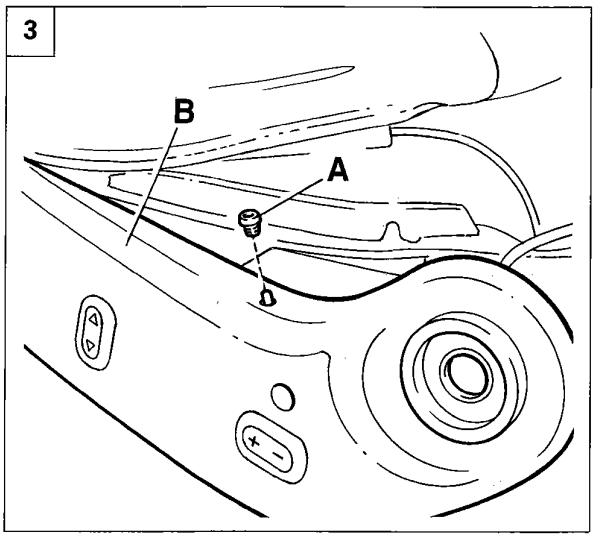


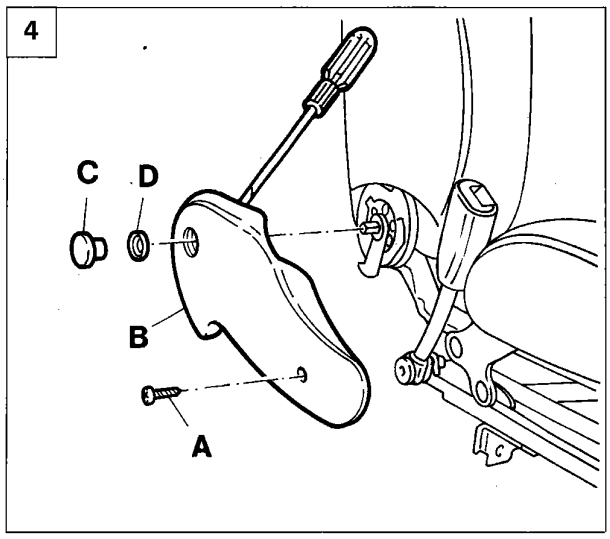




**Removing-refitting front seat cushion cover.**

Remove the front seat as described in the chapter "FRONT SEAT WITH PASSENGER PRESENCE SENSOR AND SIDE BAG"

1. Remove plug (A) and squab adjustment knob (B). Unscrew bolts (C) securing trim (D).
2. Disconnect electrical connection (A) supplying the lumbar adjustment, and electrical connection (B) supplying the seat ride adjustment.
3. Undo lock-ring (A) of the heat pad warning light (if present), then separate the seat outer trim (B).
4. Undo bolt (A) securing trim (B) to release claw washer (D), taking care not to break. Push plug (C) inwards after removing the trim, recover claw washer (D).



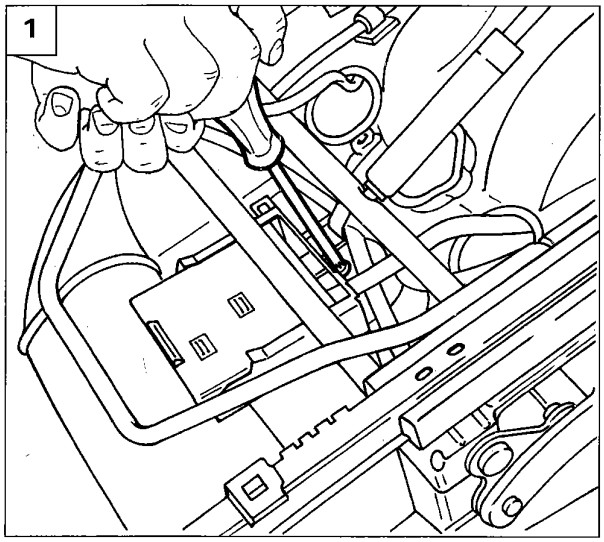







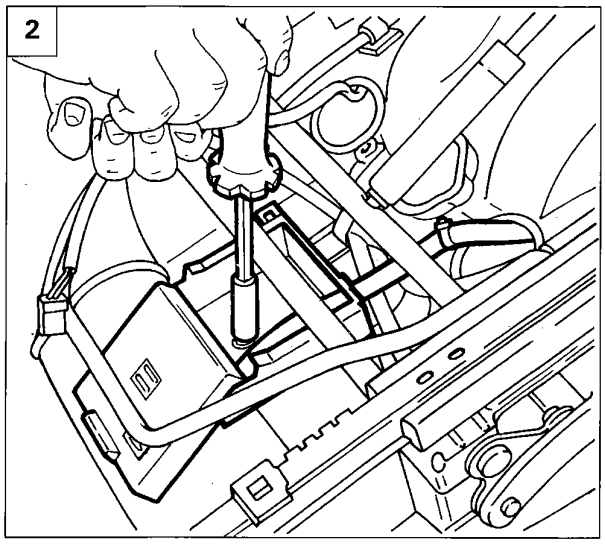
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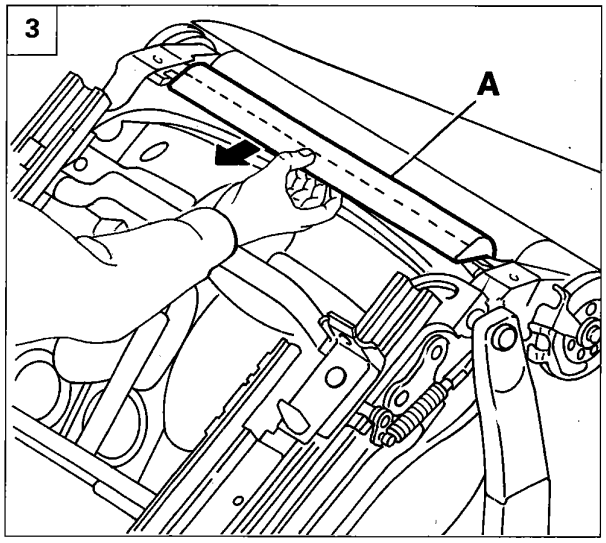


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1. Undo the bolt securing the connection carrier box.
2. Remove the box flap, undo the underlying bolt and place the connection carrier box to one side.
3. Release plastic section (A) at the rear as shown in the figure.
4. Remove plastic section B, beginning from the rear side area. Prise up with the aid of a screwdrier, then remove the cushion.

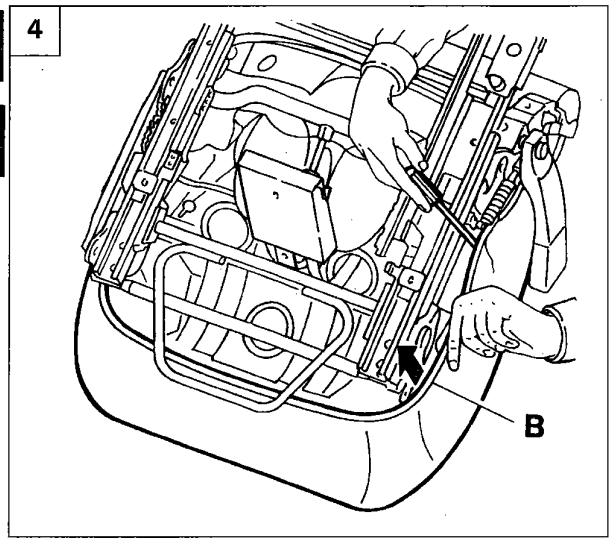
*Remove the cushion complete with cover from its seat, taking care with the electrical wiring and in particular with the passenger presence sensor and heat pad.*

3




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4

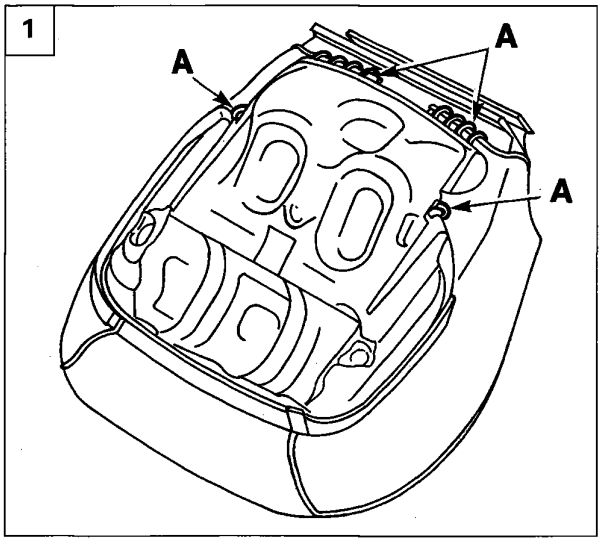



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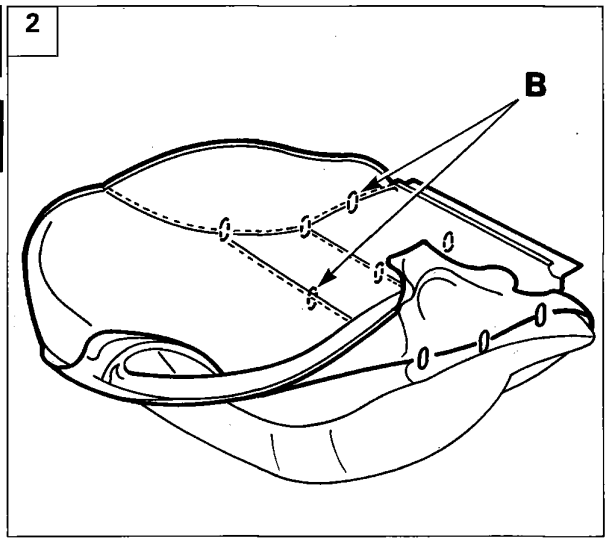


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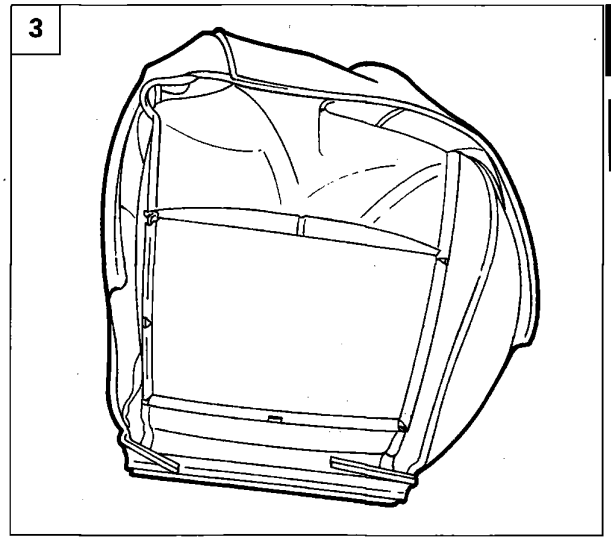
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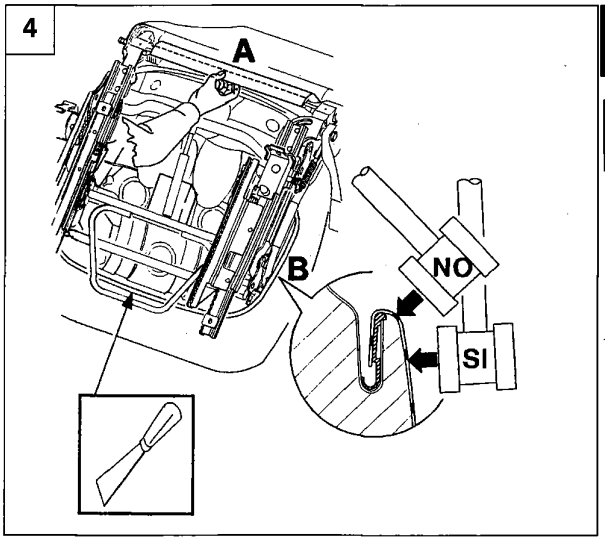

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1. Remove hooks (A) securing the cover to the padding using cutting pliers.
2. Turn the cover over and remove retaining hooks B located at the sealing edges.

*Remove any remaining hooks connected to the padding to prevent damage to the new cover.*

3. Remove the seat cushion cover from its housing.

**NOTE** *Reverse removal instructions to refit. Secure the cushion cover hooks using tool 1878077000.*

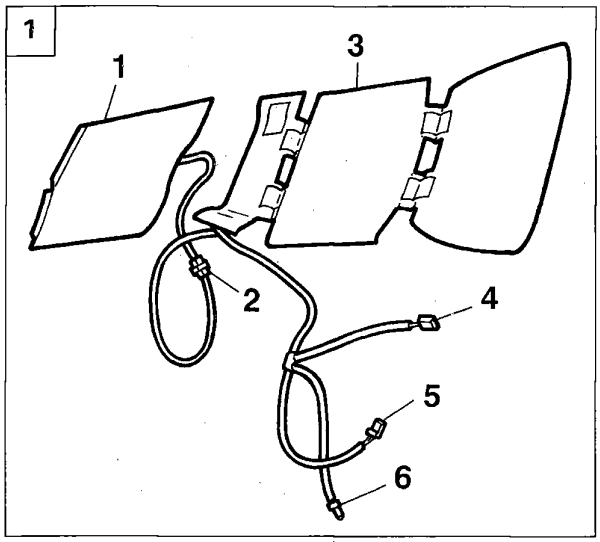
### Fitting

4. Refit the sealed cushion module to the seat frame; secure the plastic sectin (A) and secure plastic sectin (B) using a spatula and beginning from the central front area. Rivet the channel using a rubber mallet (the correct use of a rubber mallet is shown in the figure).

*The use of other tools may damage the cover.*




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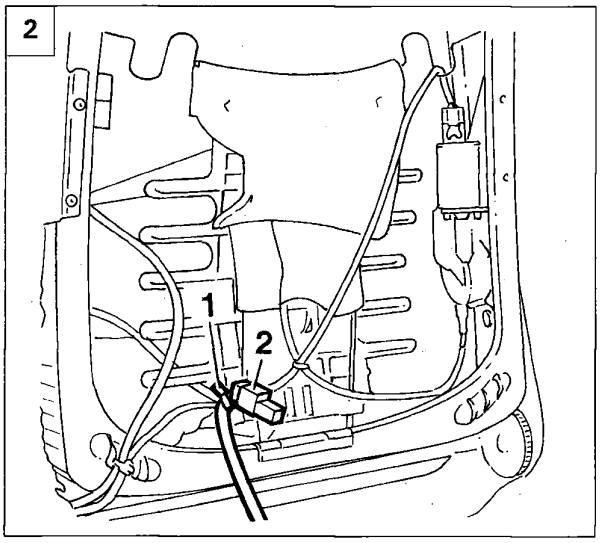
## SEAT HEAT PAD

1. Squab heat pad
2. Squab - cushion heat pad connector
3. Cushion heat pad
4. Heat pad key switch connector
5. Supply connector
6. Seat heat pad activation warning light connector

### Removing-refitting squab heat pad

Remove the front seat squab cover as described in the paragraph "Dismantling refitting front seat squab cover", except for the head restraint, releasing only the part that covers the heat pad.

**NOTE** *Remove the squab lowering lever and frame.*



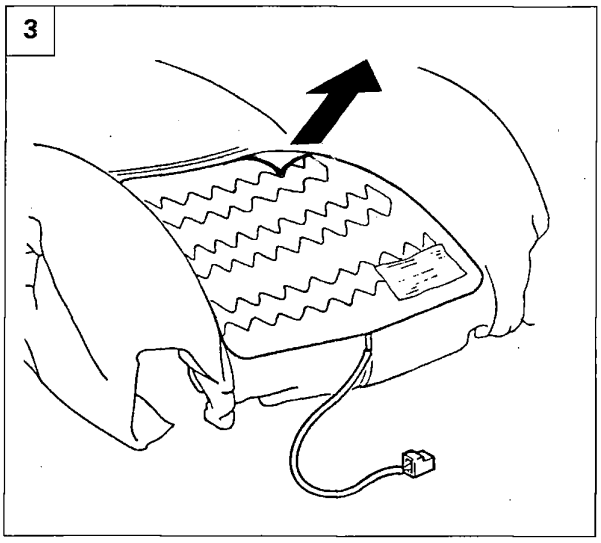

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2. Cut the retaining collar (1) and disconnect the electrical supply connection (2). Withdraw the lead by pulling it in front of the squab padding.
3. Disconnect the heat pad and remove from the seat squab padding.

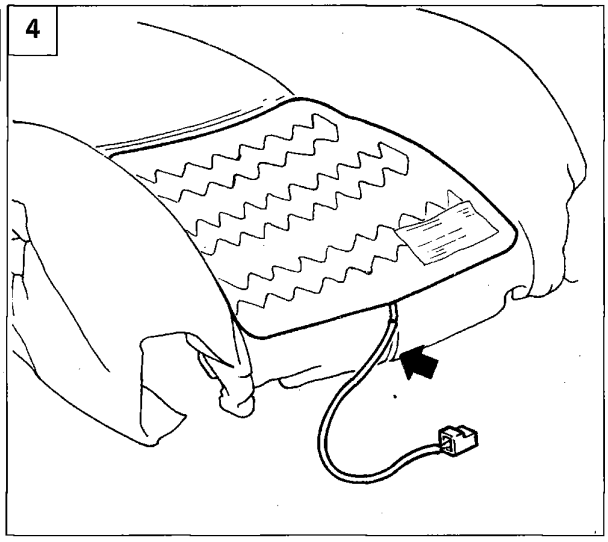
### Refitting

4. To refit, position the heat pad on the squab as shown in the figure. Thread the cable behind the padding by passing through the slot indicated on the base of the squab. Reconnect the electrical connectin and refit the squab cover as shown.

Refit the front seat squab cover.
as described in the paragraph "Dismantling assembling front seat squab cover".




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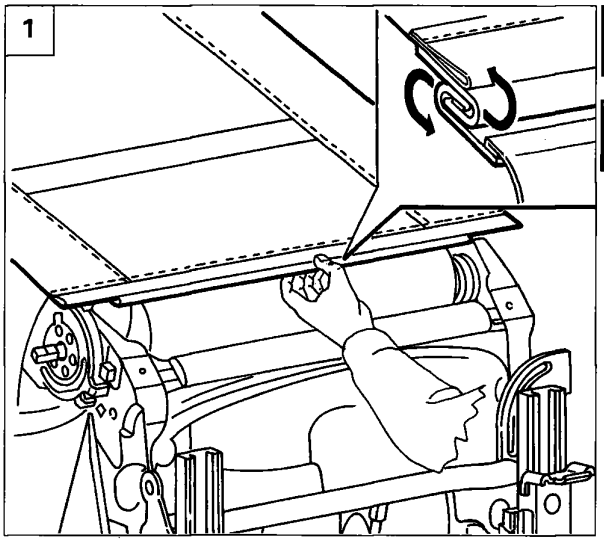



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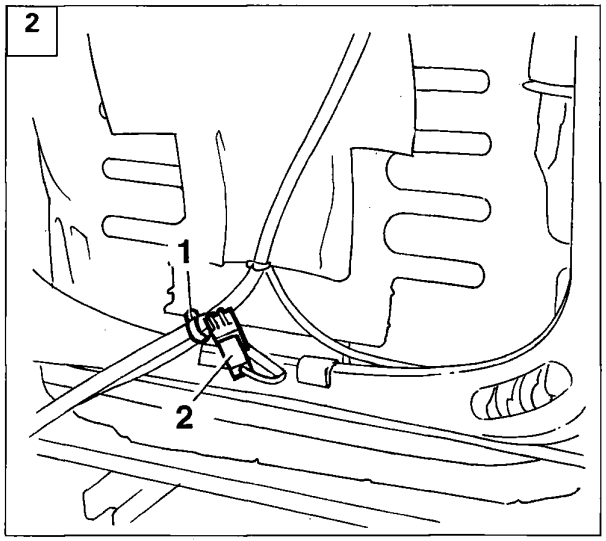


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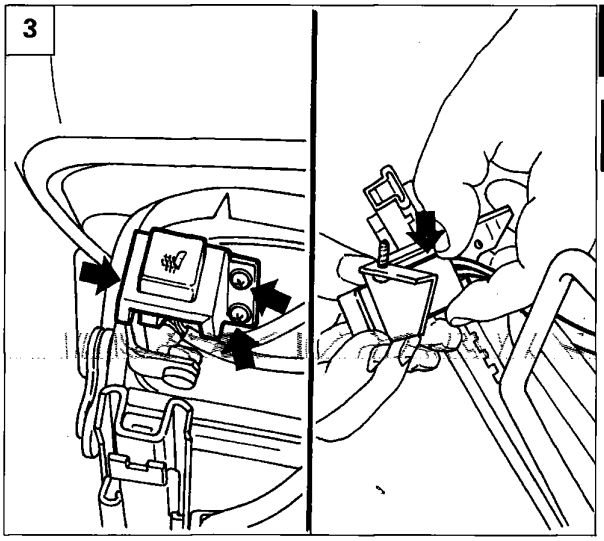
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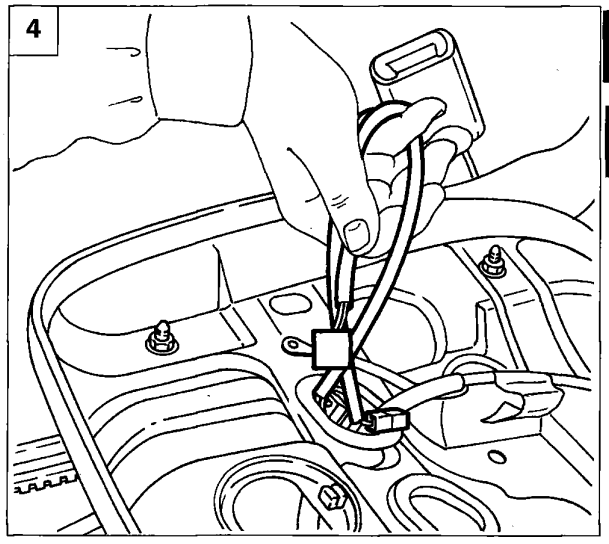
Removing-refitting cushion heat pad

1. Release the squab plastic section from its retaining system.
2. Remove the seat cover partly to cut retaining collar (1), disconnect electrical supply connection (2) and withdraw the wiring.

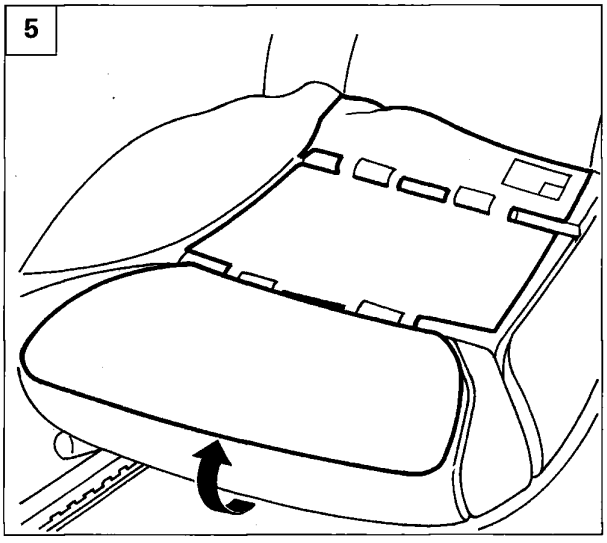
Remove the cushion cover as described in the paragraph "Removing-refitting front seat cushion cover".

3. Under the heat pad switch bolts, disconnect the heat pad electrical supply connection.
4. Raise the seat cushion padding and release the electrical wiring from the retaining clips.
5. Remove the heat pad without damaging the PPD sensor.

**NOTE** *Reverse removal instructions to refit.*




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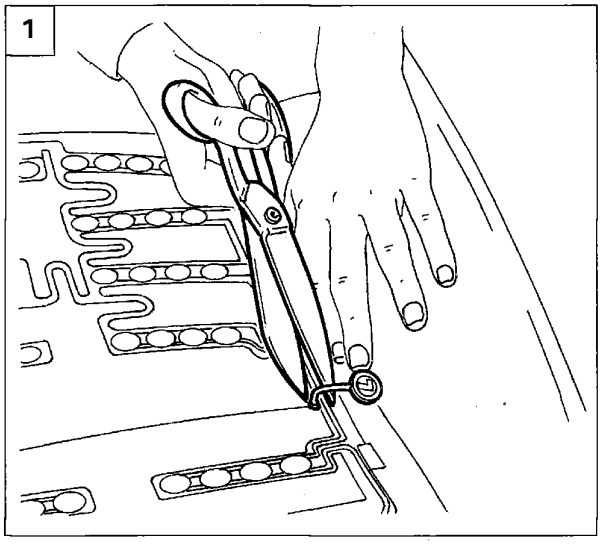



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## REMOVING-REFITTING PASSENGER PRESENCE SENSOR (PPD)




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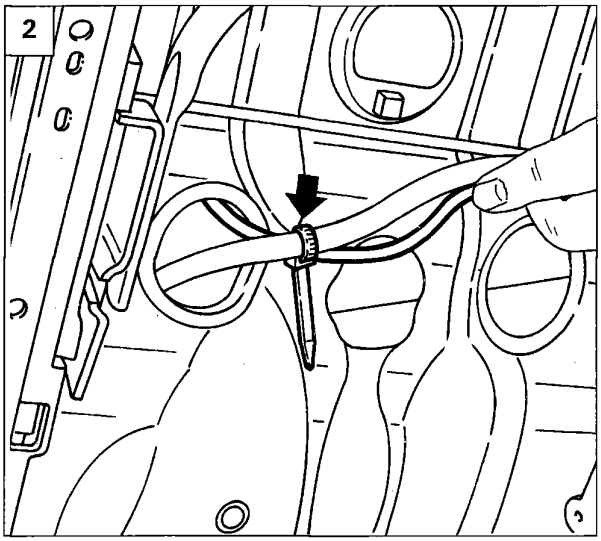
### Removing

Remove the front seat cushion cover as described in the paragraph "Removing-refitting front seat cushion" and the cushion heat pad (if present).

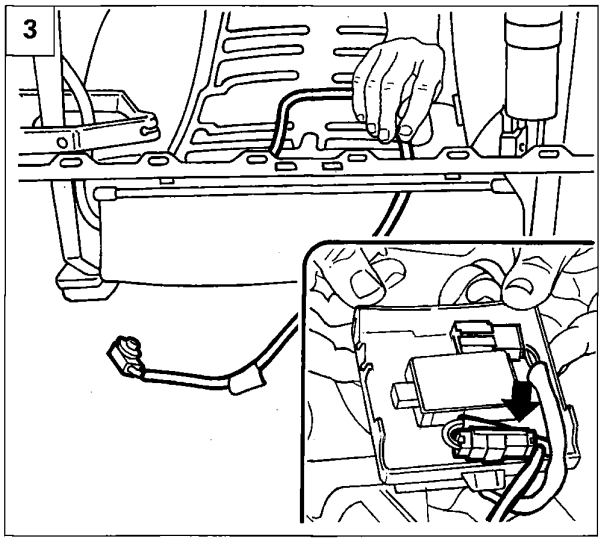
1. Cut the warranty seal, taking great care not to damage the sensor.

*The seal is fitted as a guarantee that the PPD sensor is working correctly. As soon as the seal is removed for any reason, the manufacturer's warranty is cancelled. When refitting, replace the warranty seal with an original Fiat seal.*

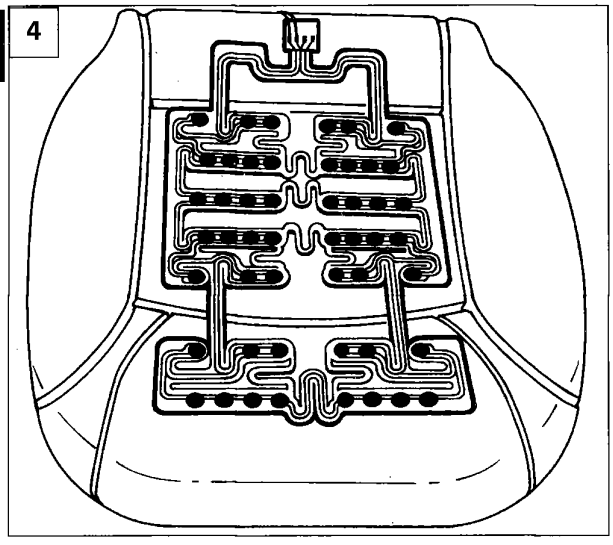
2. Release the passenger presence sensro supply lead from the retaining collar.
3. Disconnect the connector in the connector carrier box (shown magnified), then withdraw the passenger presence sensor supply lead from the bottom of the seat.
4. Disconnect the PPD sensor from the cushion padding, taking care not to damage.




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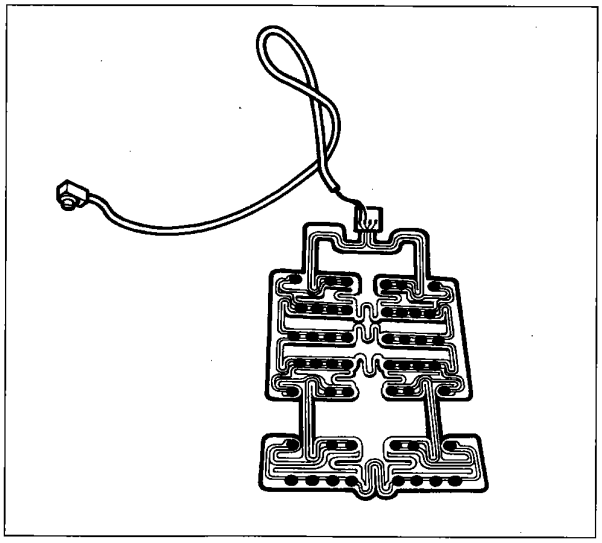



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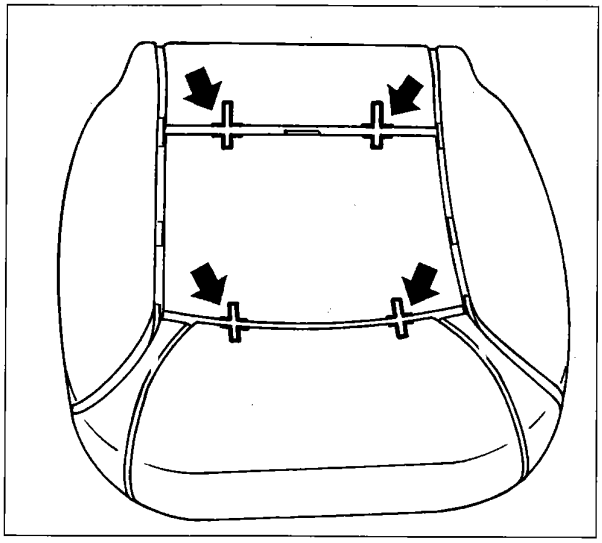
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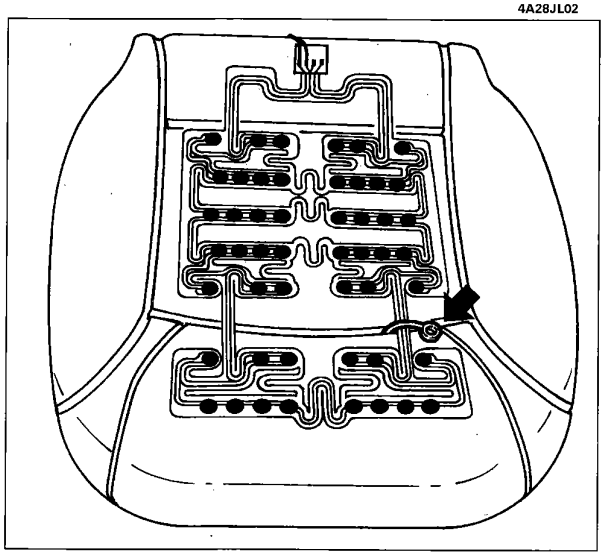
**Refitting**

- To refit, position the PPD sensor with the adhesive side facing the padding;



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- insert the PPD sensor into the notches in the cushion padding shown in the figure;



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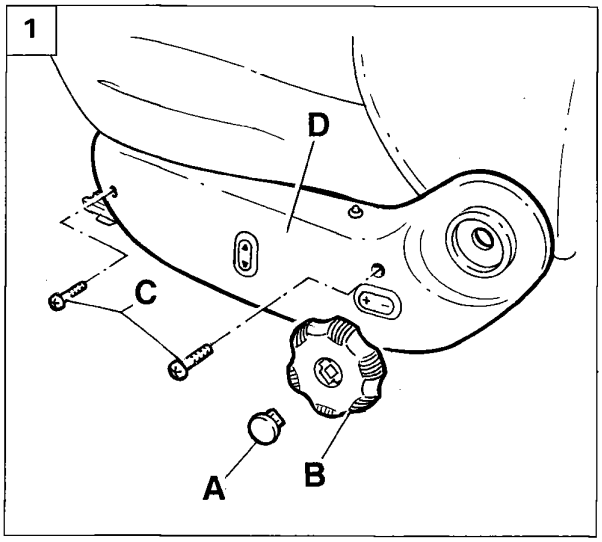
- reposition the PPD electrical wiring and restore the warranty seal.

*Whenever working on the air bag system, it is COMPULSORY to check system operation at the end of the procedure using appropriate test equipment.*



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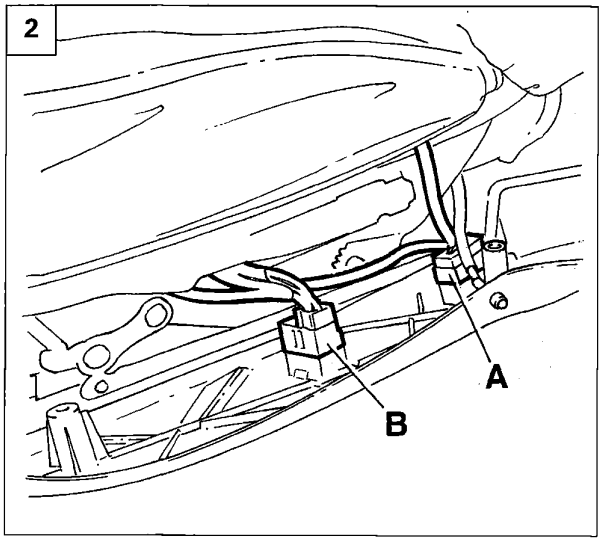

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### REMOVING-REFITTING SIDE BAG SUPPLY LEAD

Remove the side bag module as described in the paragraph "REMOVING-REFITTING SIDE BAG MODULE" shown on previous pages.

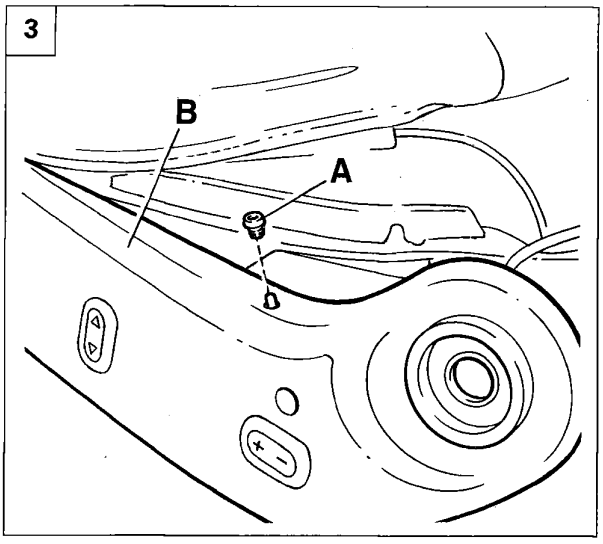
1. Remove cap A and squa adjustment knob B, unscrew bolts C securing trim D.
2. Disconnect lumbar adjustment electrical supply connection A and seat ride adjustment electrical supply connection B.
3. Unscrew lock-ring A of the heat pad warning light (if present), then separate seat exterior trim B.
4. Unscrew bolt A securing trim B to undo claw washer D, taking care to avoid breakage. Push cap C from the inside after removing the trim, recovering claw washer D.

2



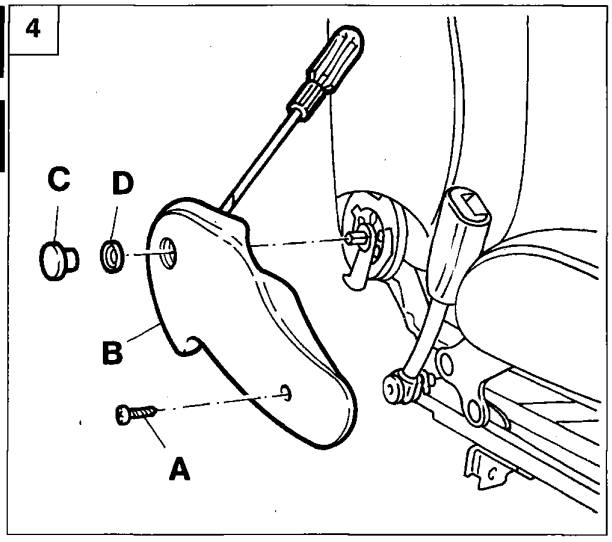

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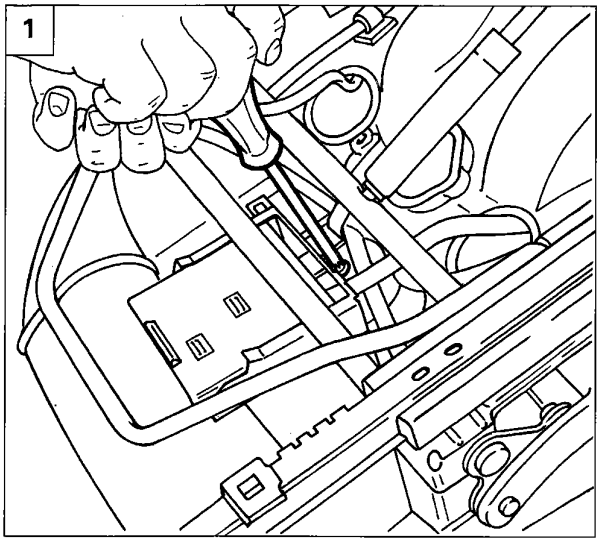



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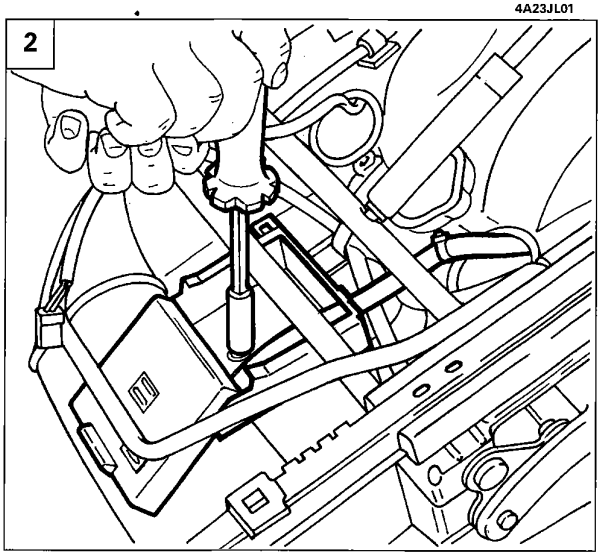


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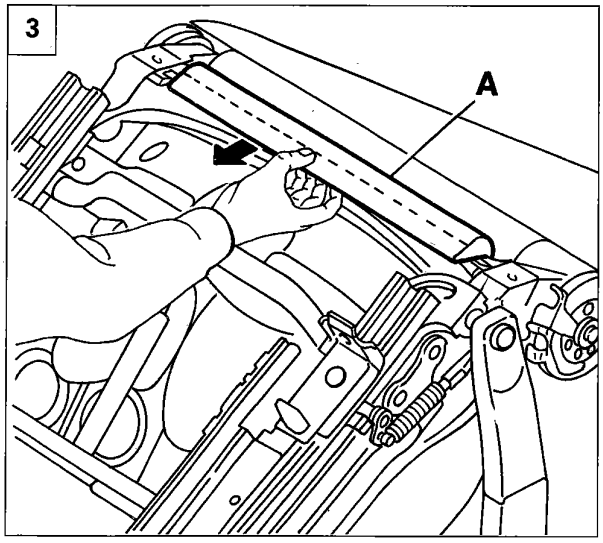

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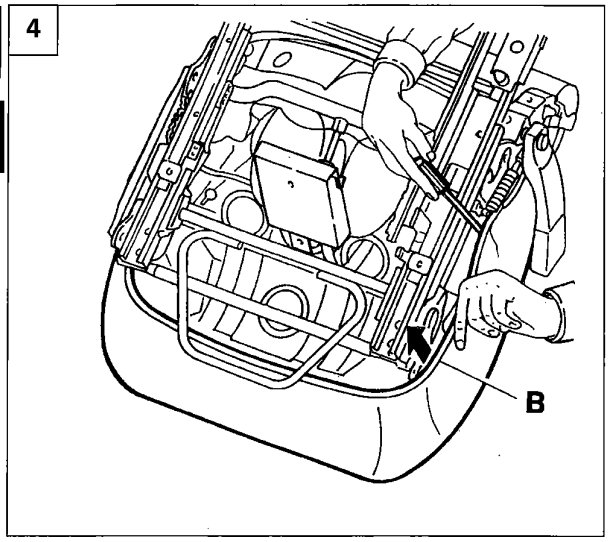

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1. Undo the connector carrier box retaining bolt.
2. Remove the box flap, undo the underlying bolt and place the connector carrier box to one side.
3. Release the plastic section (A) at the rear, working as shown in the figure.
4. Remove plastic section (B), beginning from the rear side are. Prise out with the aid of a screwdriver, then remove the cushion.

*Remove the cushion complete with cover from the seat, taking care of the electrical wiring and in particular the passenger presence sensor and heat pad.*



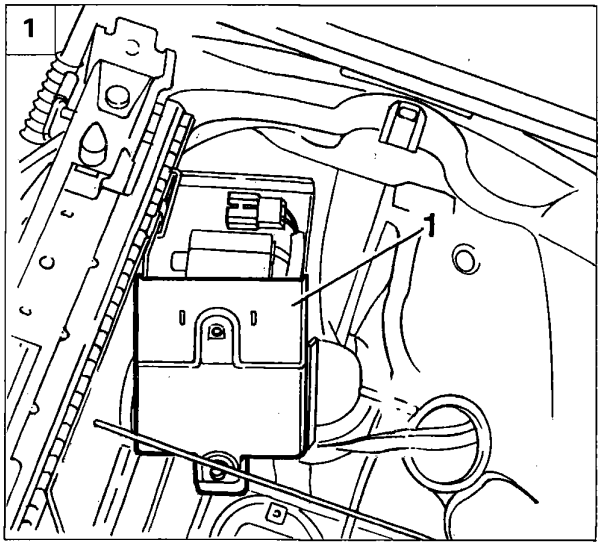

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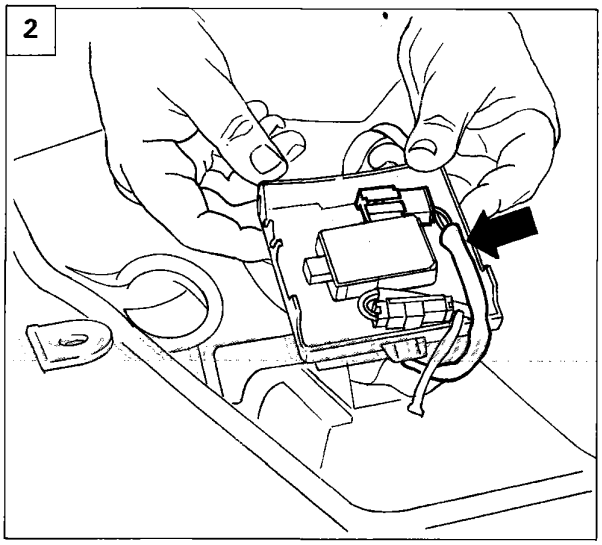

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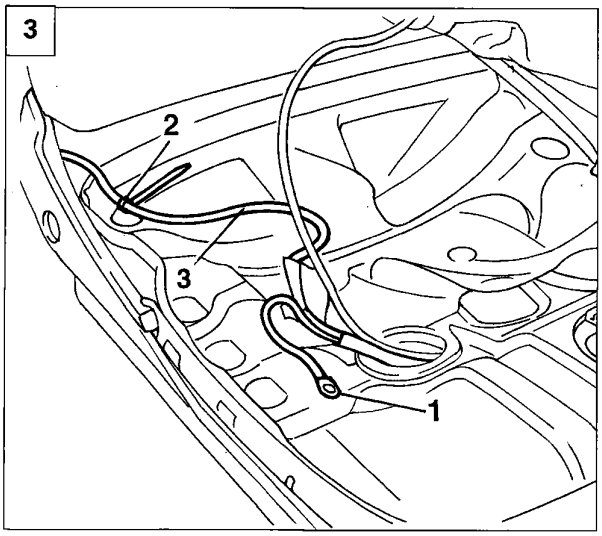
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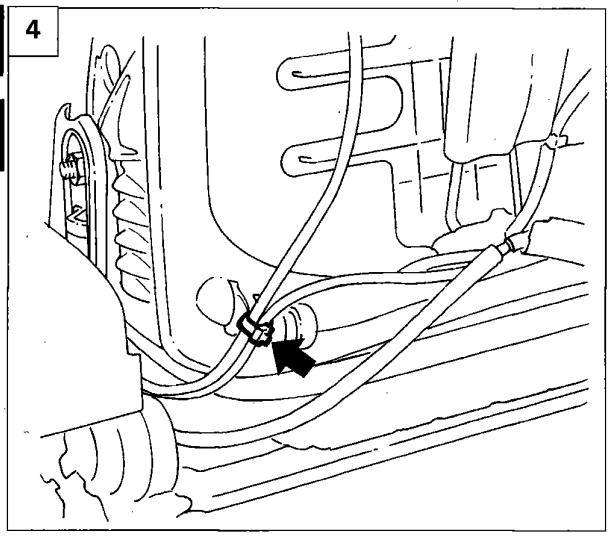
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1. Remove connector carrier flap (1) and release the supply leads.
2. Remove the side bag supply lead from the conection carrier box, shown in the figure.
3. Remove rivet (1) securing the earth lead, extend retaining collar (20 and disconnect side bag supply lead (3) from the seat.
4. Cut the collar securing the supply lead to the seat squab frame.

**NOTE** *Reverse removal instructions to refit.*



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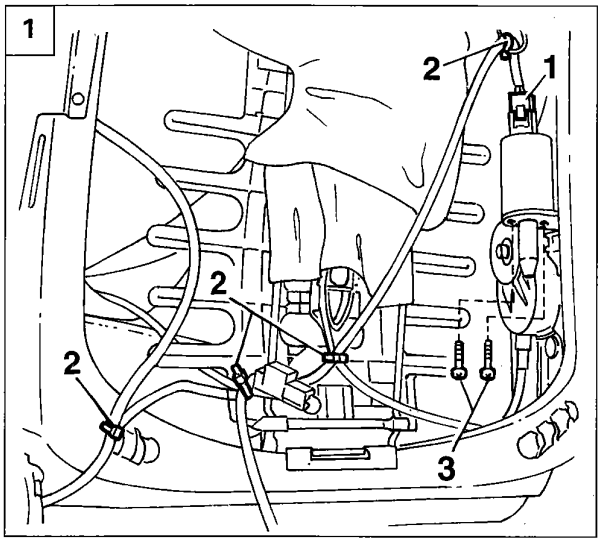
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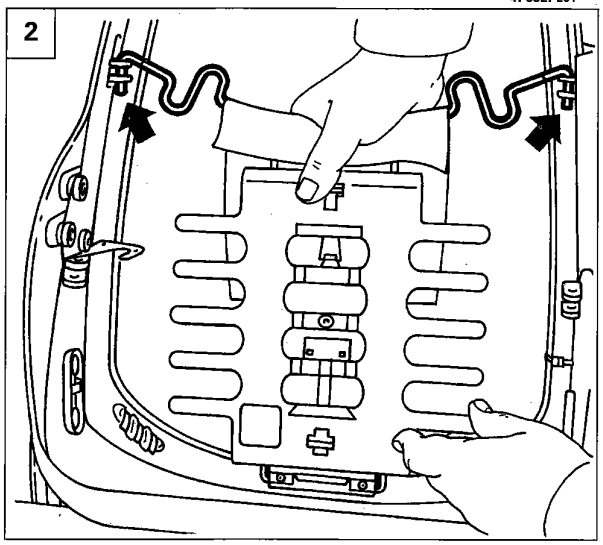
## REMOVING-REFITTING LUMBAR ADJUSTMENT DEVICE

Raise the front seat squab cover as described in the paragraph "Removingrefitting front seat squab cover".

1. Disconnect lumbar adjustment motor electrical connection (1), then disconnect collars (2) retaining the supply lead and undo bolts (3) securing the motor to the bracket.
2. Undo the hooks securing the lumbar adjustment device to the squab frame.
3. Undo the bolts securing the lumbar adjustment device shown in the figure.
4. Remove the lumbar adjustment device from the seat squab.

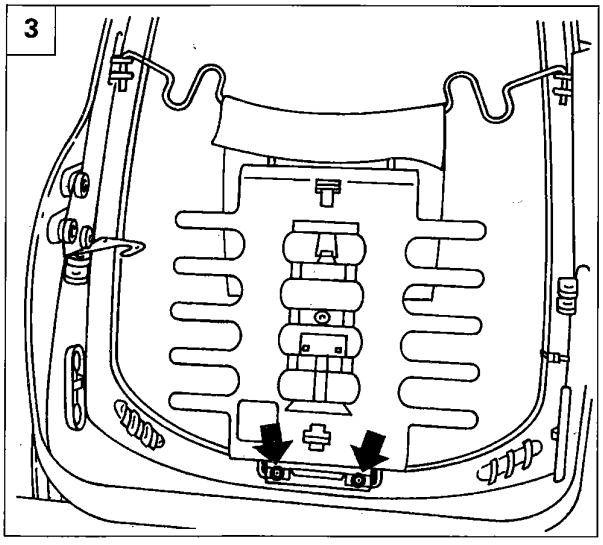
**NOTE** *Reverse removal instructions to refit.*

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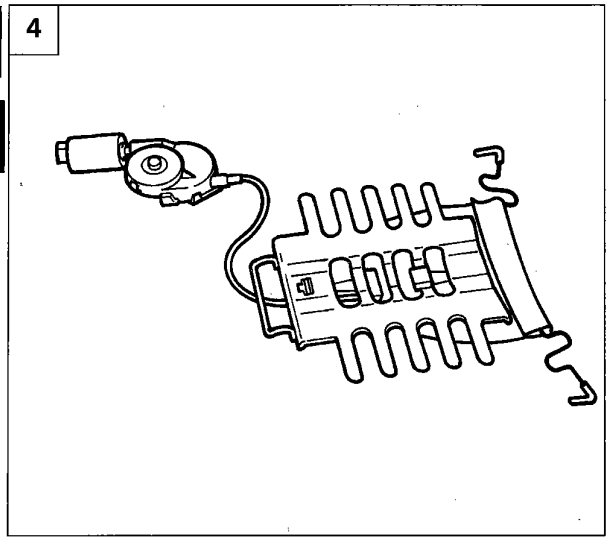
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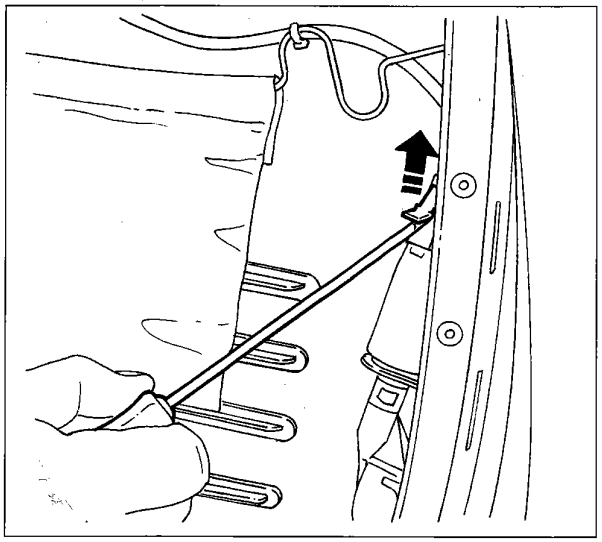
4



4A32JL04



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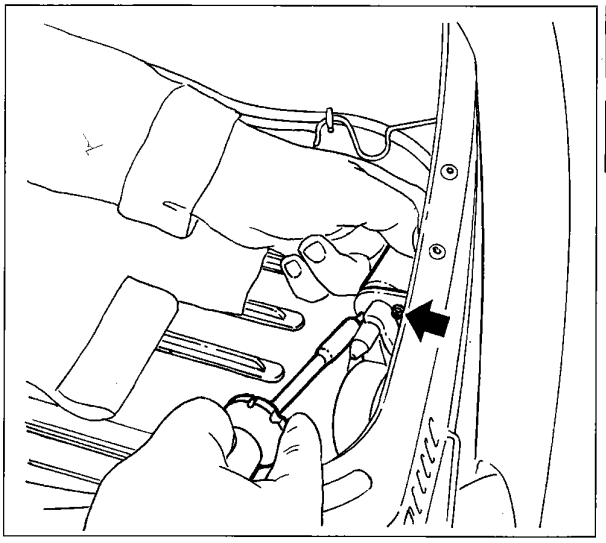


4A33JL01

**Removing-refitting lumbar adjustment device motor**

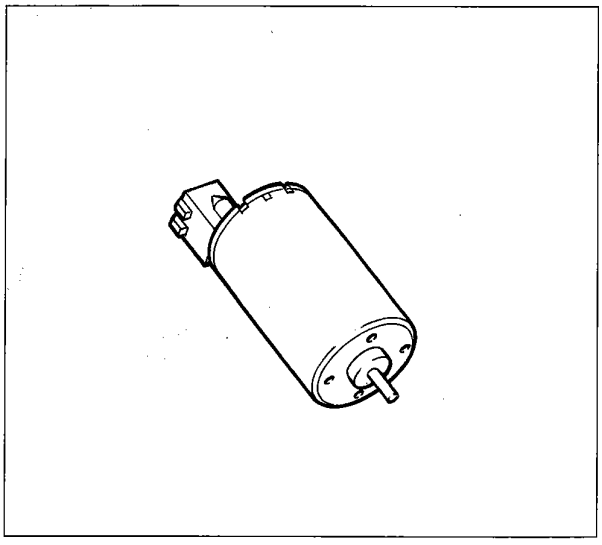
Remove the front seat squab cover as described in the paragraph "Removing-refitting front seat squab cover", except for the head restraint.

- Disconnect the lumbar adjustment motor electrical supply connection;



4A33JL02

- undo the motor retaining bolts shown in the figure;



4A33JL03

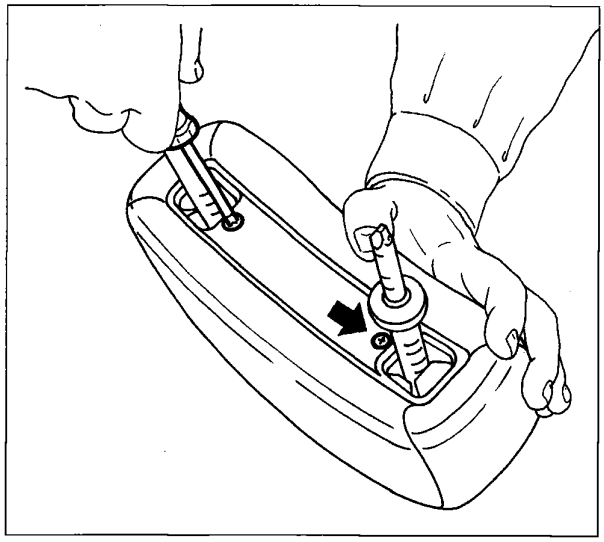
- remove the lumbar adjustment device from its seat.

**NOTE** *Reverse removal instructions to refit.*



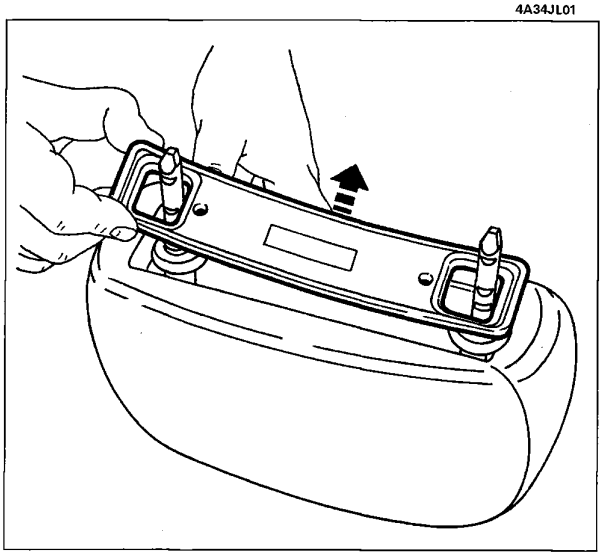
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# 55.



4A34JL01

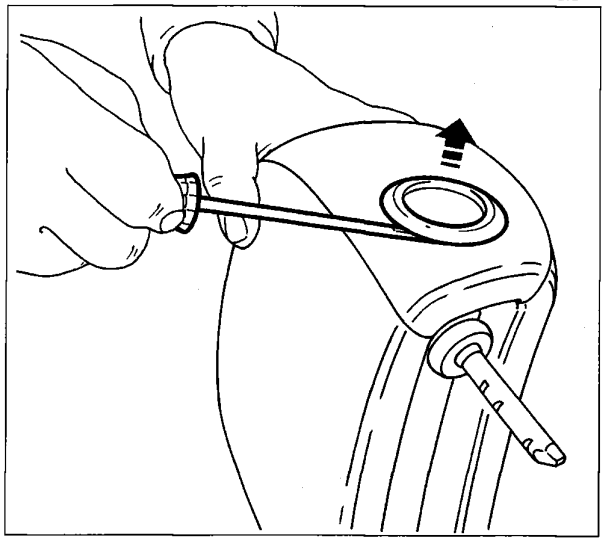
## DISMANTLING THE HEAD RESTRAINT



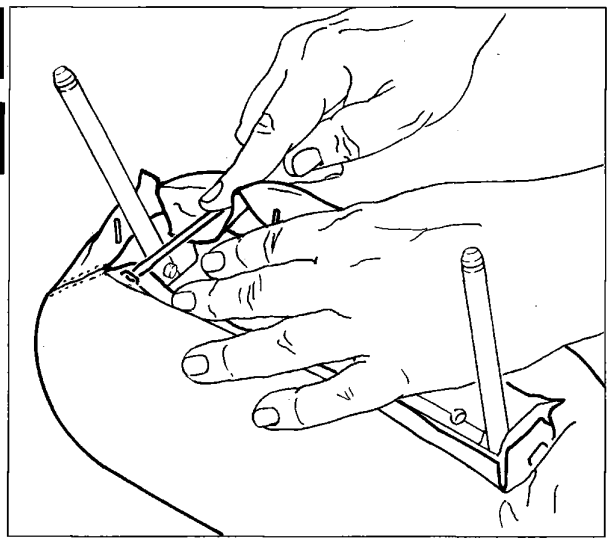
4A34JL02

Remove the head restraint as described in the paragraph "Removing-refitting front seat squab cover".

1. Undo the cover retaining plate bolts.
2. Raise the panel and remove from the head restraint.
3. Prise up the frame and the head restraint height adjustment button.
4. Raise the anchorage hooks from the head restraint trim and remove.



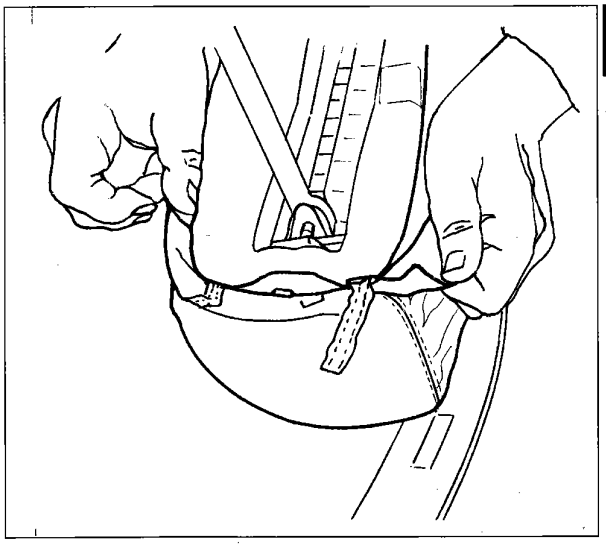
4A34JL03



3U84NL07

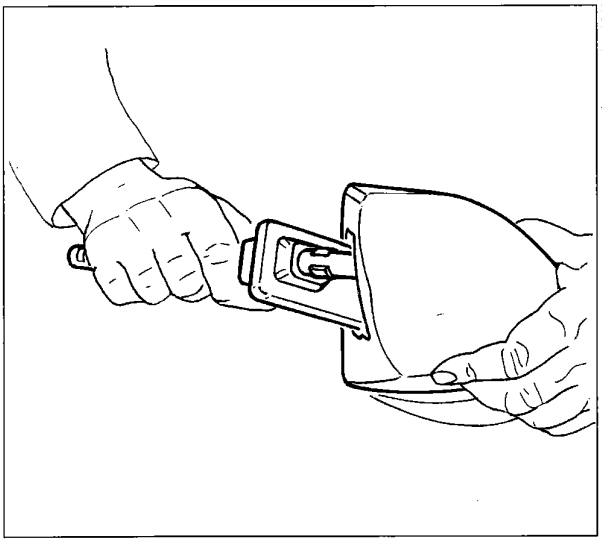


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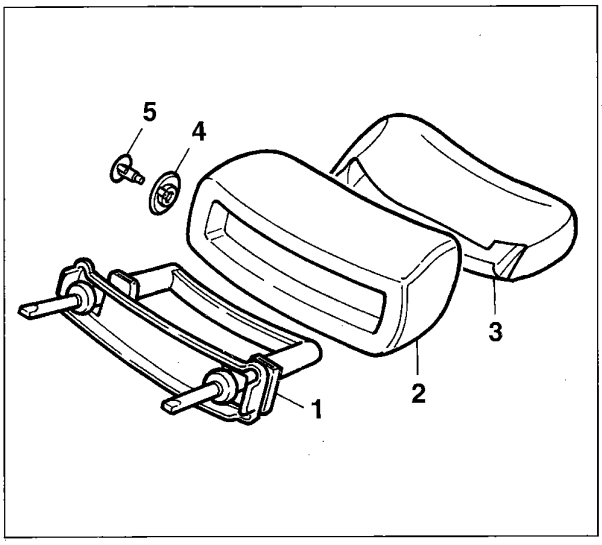
3U84NL08

- Prise up the trim from the head restraint padding;



3U85NL05

- separate the padding from the head restraint structure;



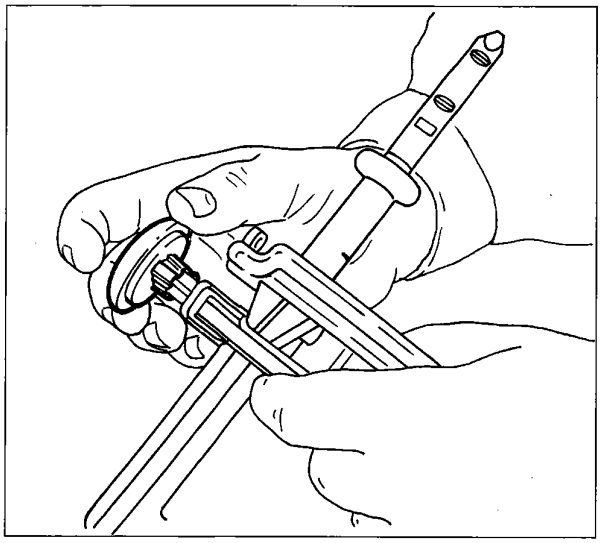

4A35JL03

- structure (1), padding (2), trim (3), frame (4), button (5);



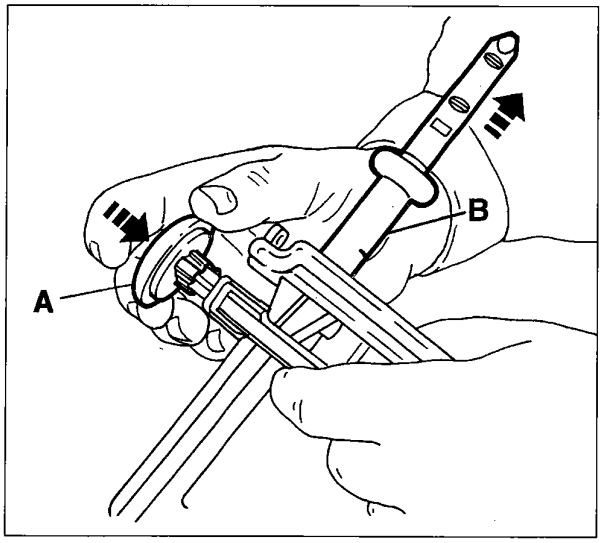
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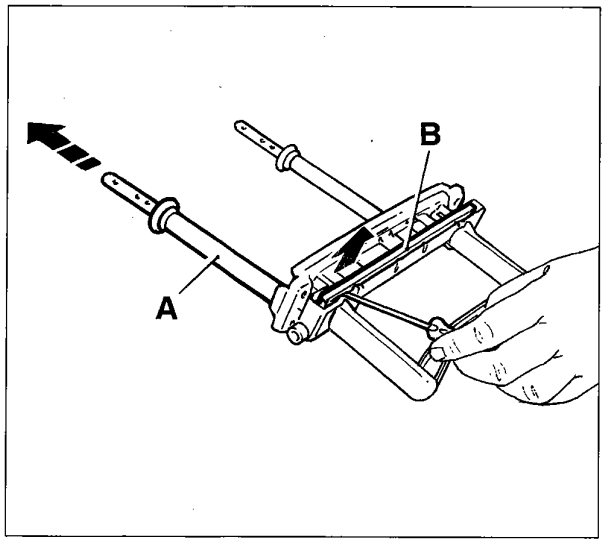
4A36JL01

- position the head restraint height adjustment button in its housing;




4A36JL02

- press button (A) and position head restraint rod (B) at the end of its course;
- remove the button fitted previously;



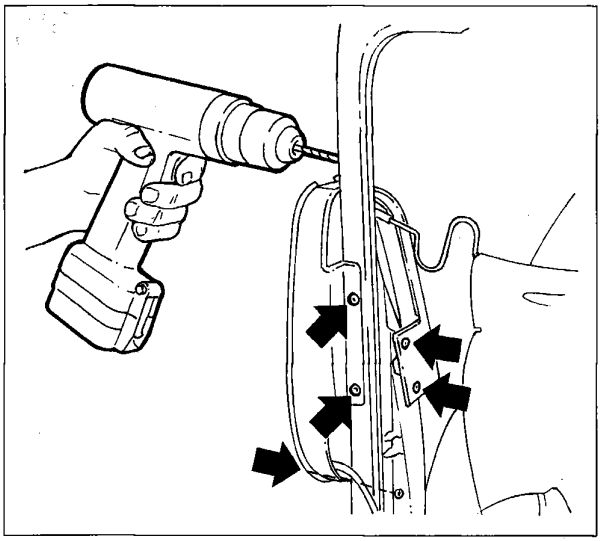

4A36JL03

- handle detent insert (B) carefully to prevent the retaining clip coming out, the remove head restraint rod (A).

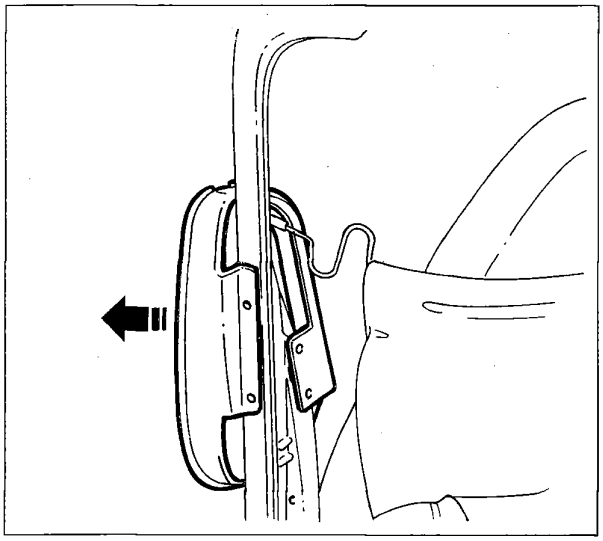
**NOTE** *Reverse removal instructions to refit.*



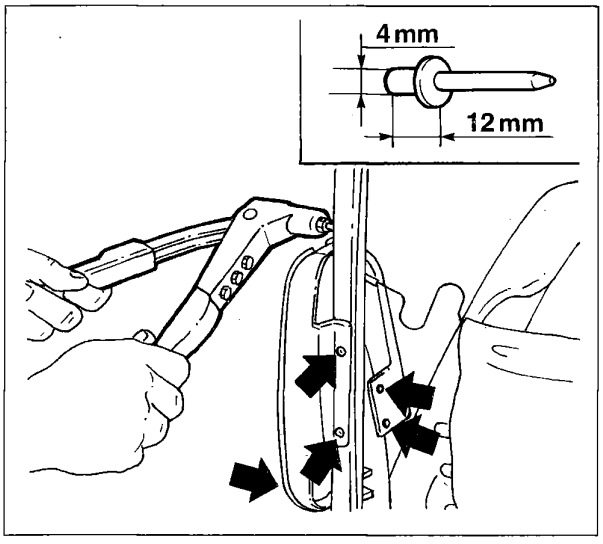
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4F037FL01



4F037FL02




4F037FL03

## REMOVING-REFITTING SIDE BAG FRAME

### Removing

Remove the squab cover as described in the paragraph "REMOVING-REFITTING FRONT SEAT SQUAB COVER"

- Remove the preformed padding from its seat to gain access to the side bag frame, then use a drill with a 4 mm bit at the points indicated;

- Remove the side bag frame from the seat squab frame.

### Refitting

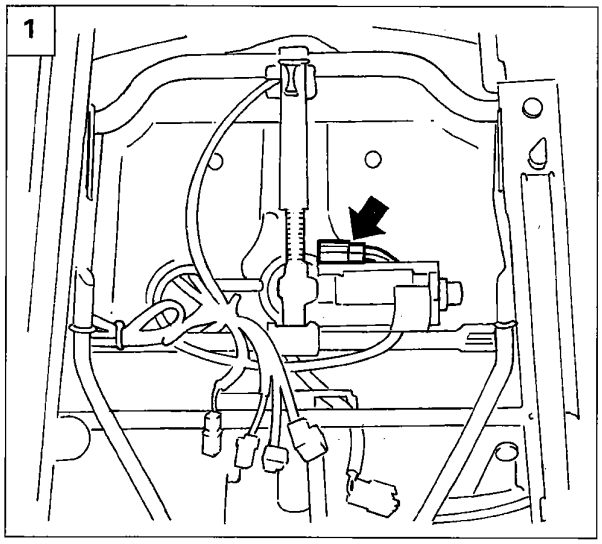
- Position the side bag frame and fit rivets of the size shown in the figure at the points indicated by arrows.



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# 55.

1

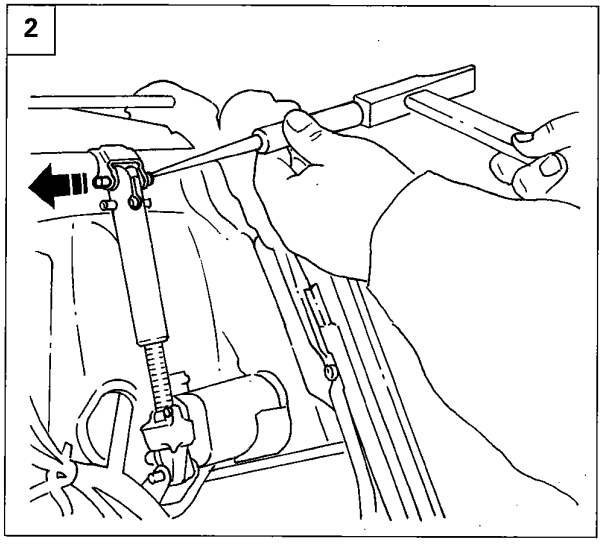


4F038FL01

## REMOVING-REFITTING SEAT HEIGHT-ADJUSTMENT MOTOR

Remove the front seat as described in the paragraph "REMOVING-REFITTING FRONT SEAT WITH PASSENGER PRESENCE SENSOR AND SIDE BAG"

2

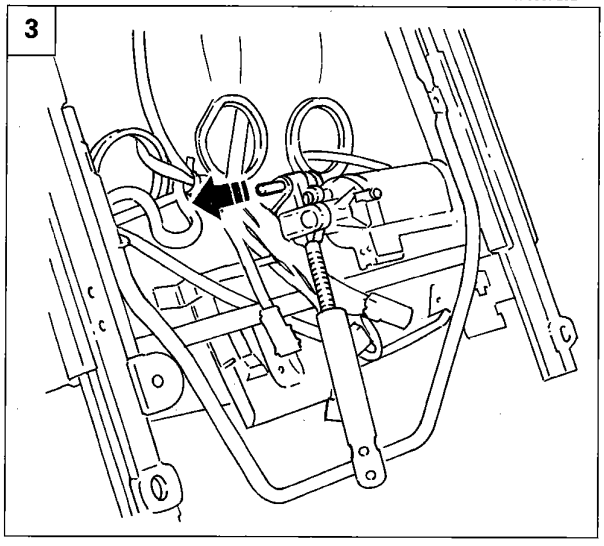


4F038FL02

1. Position the seat on the bench and disconnect the height-adjustment motor supply connection.
2. Use a suitable drift to remove the upper pin securing the height-adjustment motor adjustment rod.
3. Turn the motor adjustment rod over and remove the lower retaining pin using a suitable drift.
4. Remove the height-adjustment motor from the seat.

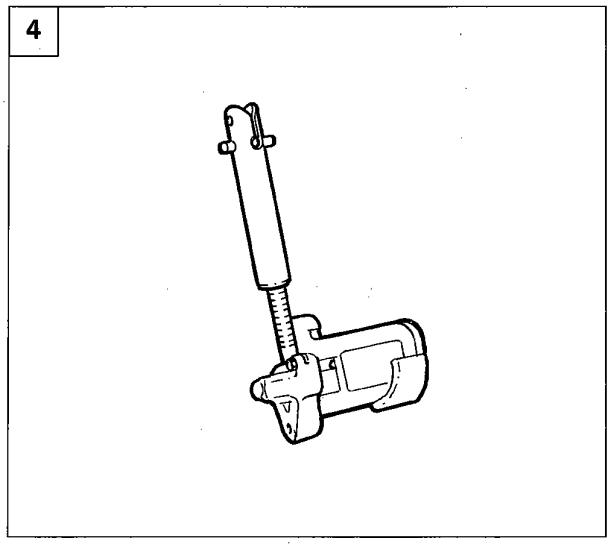
NOTE *Reverse removal operations to refit.*

3



4F038FL03

4

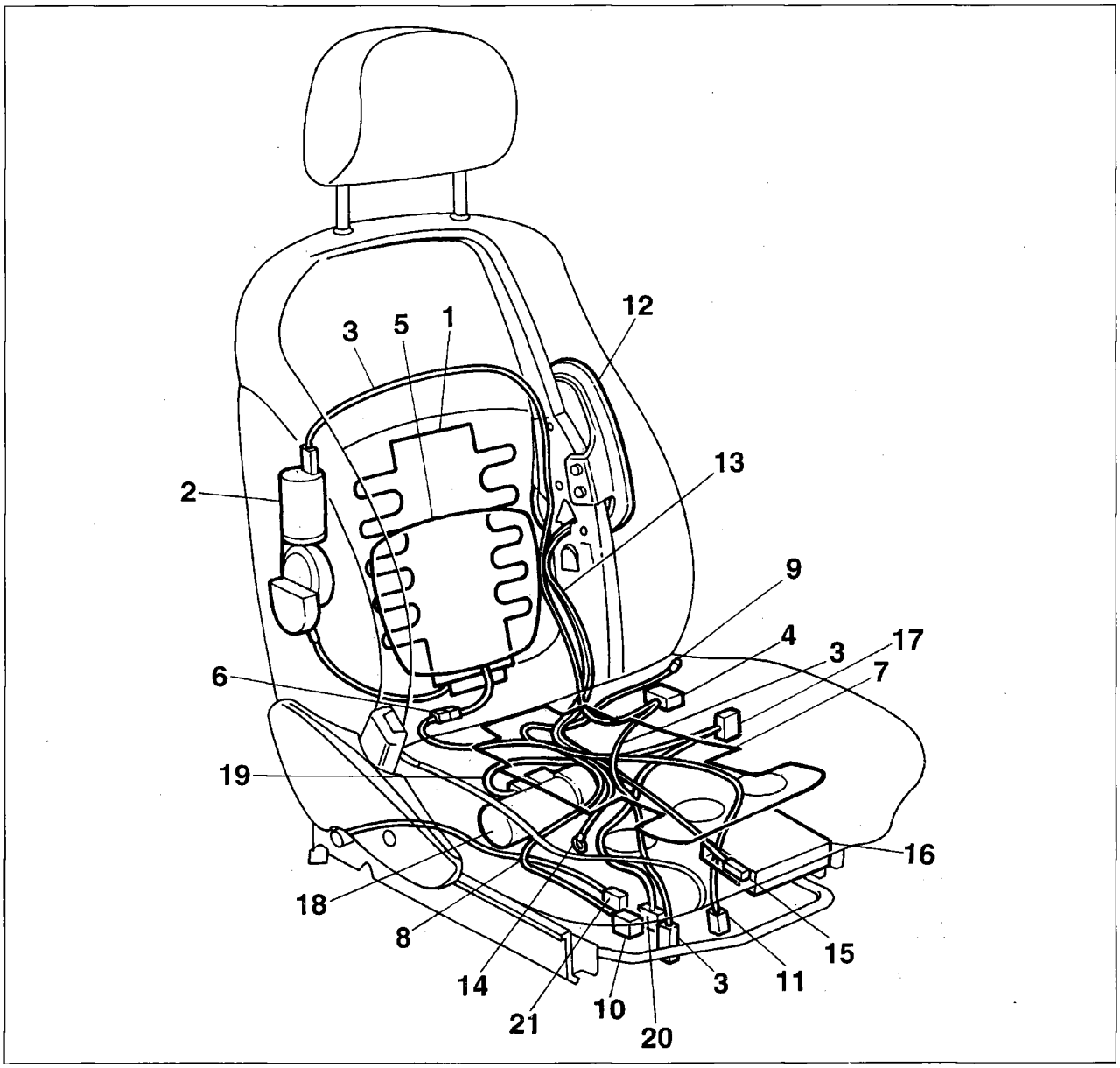


4F038FL04



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## LOCATION OF DRIVER'S SEAT COMPONENTS




4F039FL01

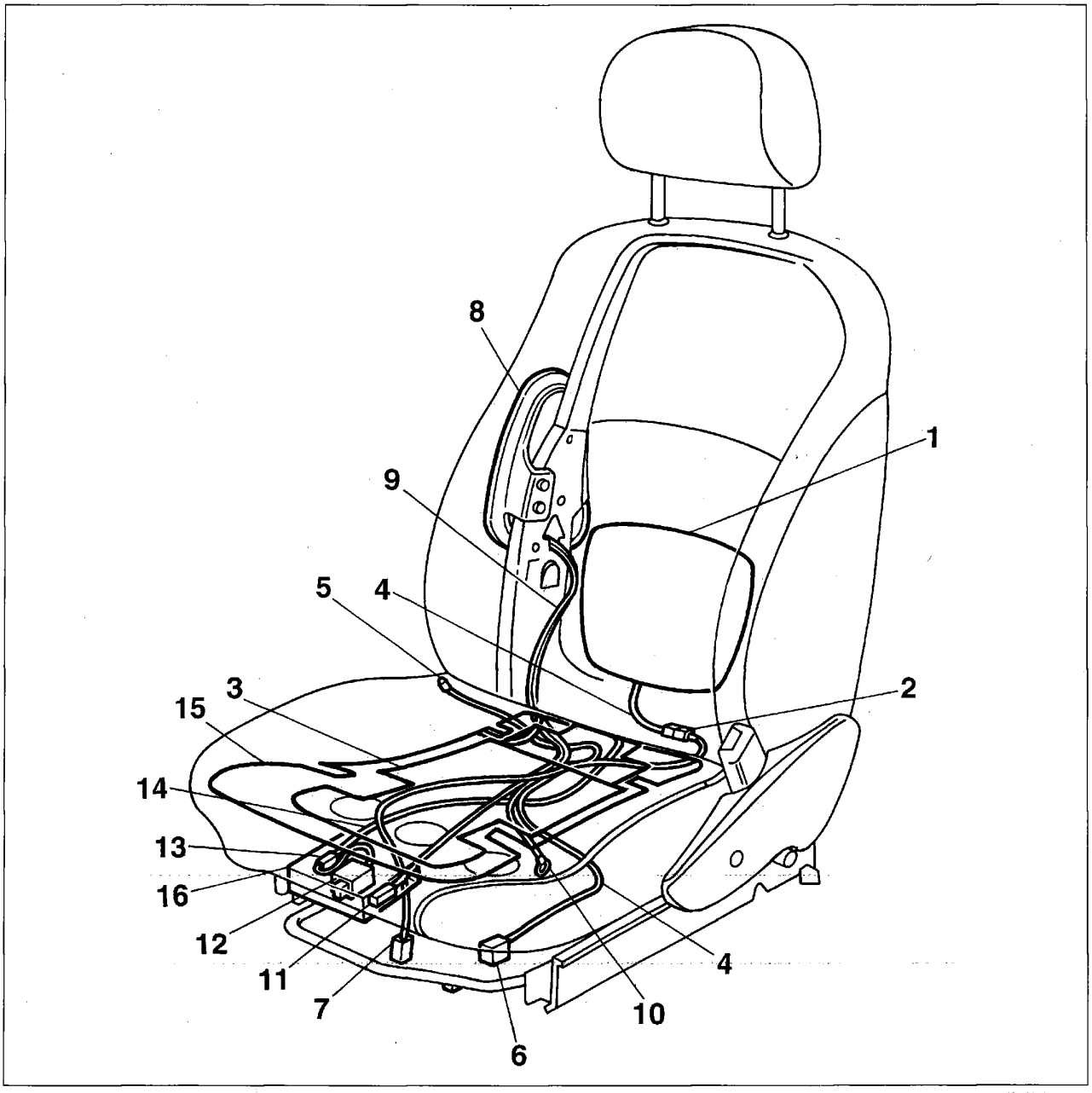
1. Lumbar adjustment device
2. Lumbar adjustment motor
3. Lumbar supply lead
4. Lumbar adjustment switch
5. Squab heat pad
6. Squab and cushion heat pad connector
7. Cushion heat pad
8. Heat pad supply lead
9. Heat pad warning light
10. Heat pad switch
11. Heat pad power supply
12 Side bag
13. Side bag supply lead
14. Side bag earth
15. Side bag power supply
16. Connection carrier box
17. Height adjustment switch
18. Height adjustment motor
19. Wiring
20. Height adjustment power supply
21. Safety circuit power supply



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# 55.

## LOCATION OF PASSENGER SEAT COMPONENTS




1. Squab heat pad
2. Squab and cushion heat pad connector
3. Cushion heat pad
4. Heat pad supply lead
5. Heat pad warning light
6. Heat pad switch
7. Heat pad power supply
8. Side bag
9. Side bag supply lead
10. Side bag earth
11. Side bag power supply
12. Passenger presence sensor PPD interface control unit
13. Passenger presence sensor connector (PPD) with interface control unit
14. Passenger presence sensor (PPD) supply lead
15. Passenger presence sensor
16. Connection carrier box

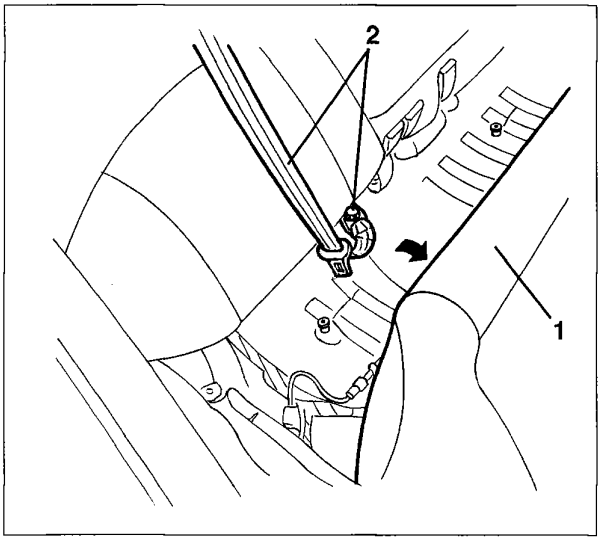


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## SEATS

- Foldable single rear seat backrest - R & R. 1
- Complete rear seat foldable backrest - R & R. 1
- Attachment lock for foldable rear seat foldable backrest - R & R 2
- Rear seat central headrest - R & R 3
- Rear seat central headrest - Disassembly and reassembly 5
- Rear seat side headrest - R&R 8
- Rear seat side headrest - Disassembly. 8
- Rear central searbelt with reel - R&R 9

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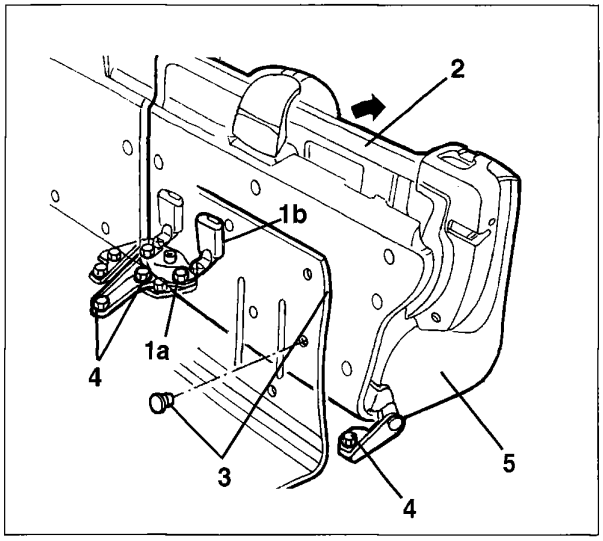



4F001EM01

## REAR SEAT SINGLE FOLDABLE BACK-REST - R&R

1. **R**emove the rear seat cushion
2. (**O**nly applies to right backrest) Undo the bolt and move the end of the seat belt .

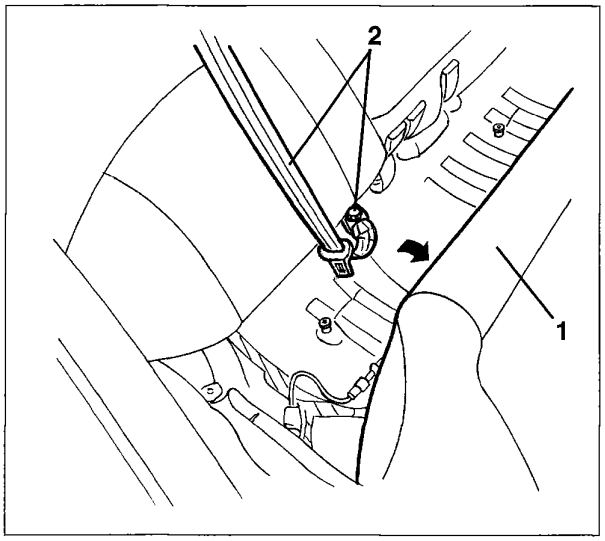
When reassembling, tighten to a torque of 4 da**N**m




4F001EM02

1. **T**ighten bolt (1a) and remove side seatbelt link (1b).
2. **L**ower the backrest .
3. Disengage the retainers and remove the the boot compartement lining from the back-rest.
4. Undo the backrest bracket retaining bolts.
5. **R**emove the backrest.

**NOTE** *To refit, reverse the operations used for removal.*




4F001EM03.

## REAR SEAT COMPLETE FOLDABLE BACKREST - R&R

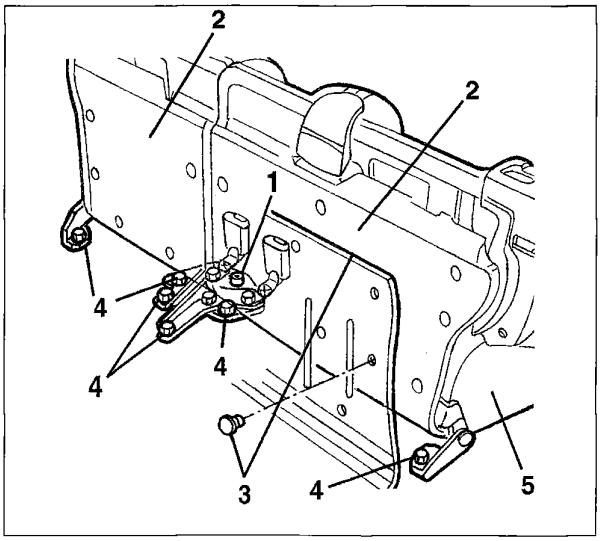
1. **R**emove the rear seat cushion.
2. Undo the bolt and move the end of the seat belt.

When reassembling, tighten to a torque of 4 da**N**m.



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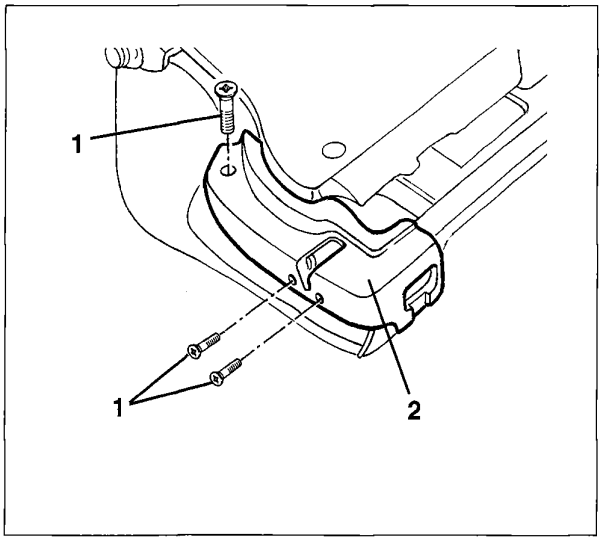
# 70.




4F002EM01

1. Undo the front central bolt.
2. Lower the backrest.
3. Disengage the retainers and remove the the boot compartement covering from the backrest.
4. Undo the backrest bracket retaining bolts.
5. Remove the complete backrest.

**NOTE** *To refit, reverse the operations used for removal.*



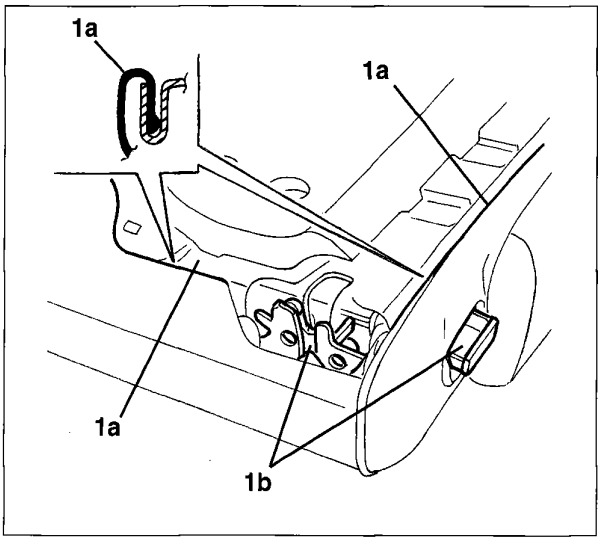

4F002EM03

## ATTACHMENT LOCK FOR REAR SEAT FOLDABLE BACKREST - R & R

### Removal

- Remove the rear seat cushion.

1. Lower the backrest and undo the cover retaining bolts.
2. Remove the cover.

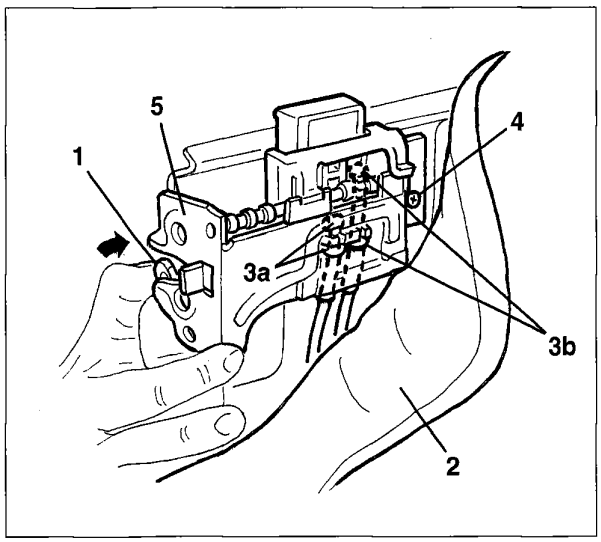



4F002EM03

1. Remove lining (1a) along the edge of the backrest up to the attachment lock area (1b).

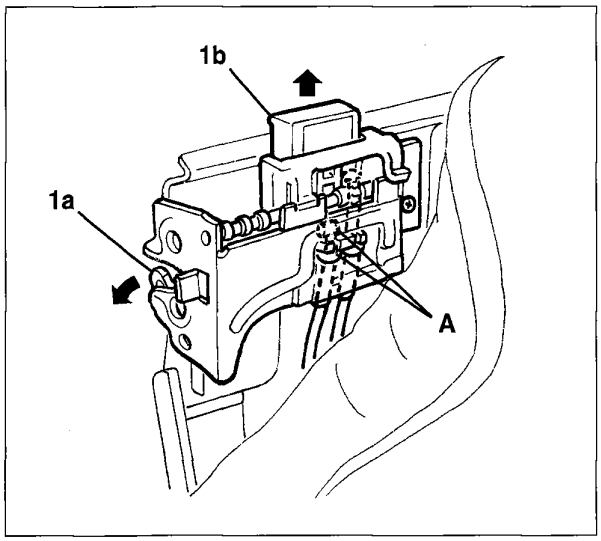


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4F003EM01

1. Manually reconnect the lock .
2. Carefully remove the lining with padding .
3. Disconnect the lock pin cable (3a) and the seatbelt reel control cable (3b) form the lock.
4. Undo the bolt.
5. Remove the lock.



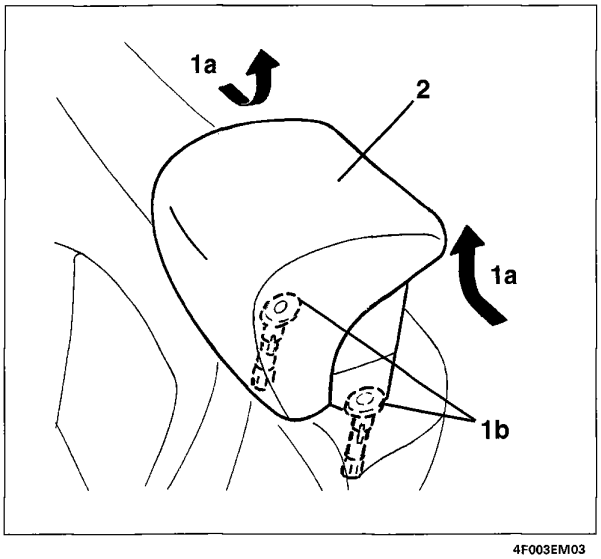

4F003EM02

### Refitting

1. Disconnect the lock (1a) removing the button (1b).

Refit by reversing the operations used for removal.

**NOTE** *To help reattach lock pin cable (A), first fit the lock pin itself .*




4F003EM03

## REAR SEAT CENTRAL HEADREST - R & R.

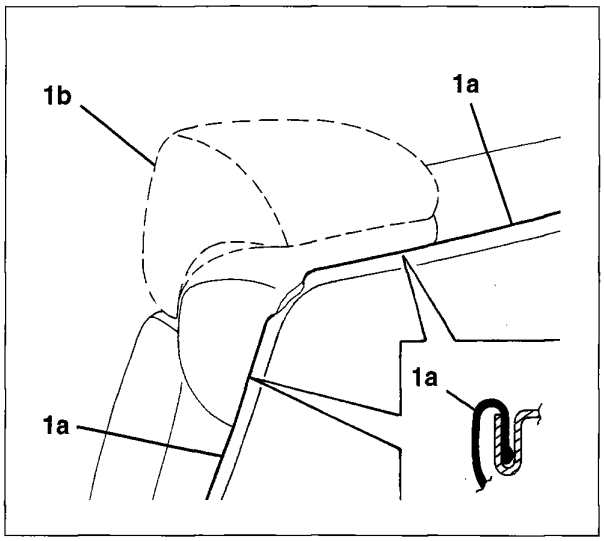
### Removal

1. Push and lift the head rest fiirst from one side (1a) then from the other, after disconnecting the pins from their sleeves (1b).
2. Retrieve the headrest.



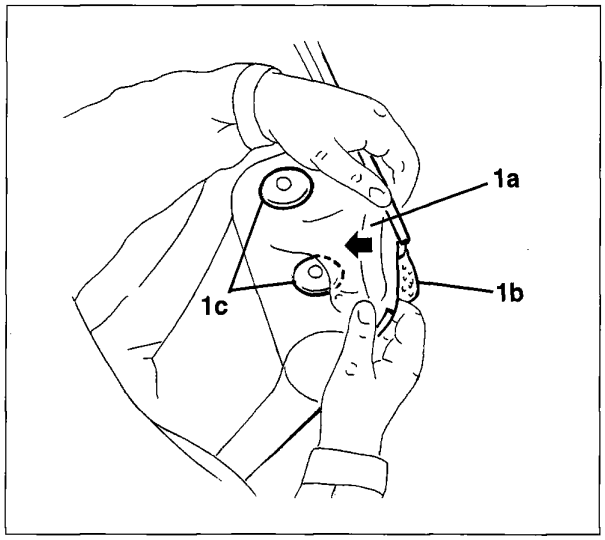
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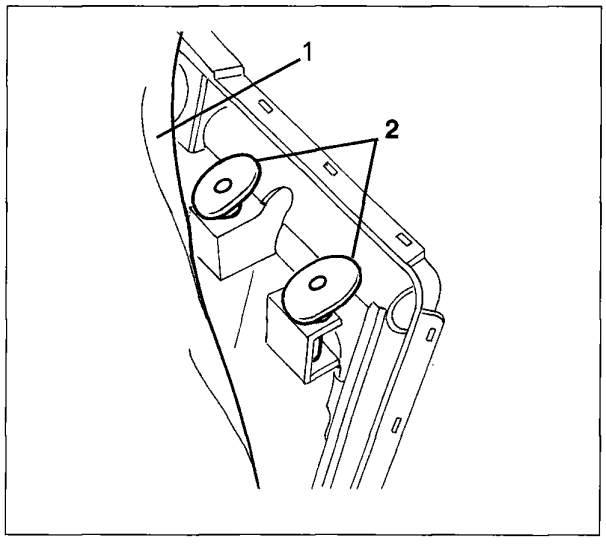

4F004EM01

- Lift the rear seat cushion and lower the left backrest.
1. Remove the lining (1a) along the edges of the backrest, up to the headrest area (1b).




4F004EM01

1. Remove lining (1a) and padding (1b) from sleeves (1c).




4F004EM01

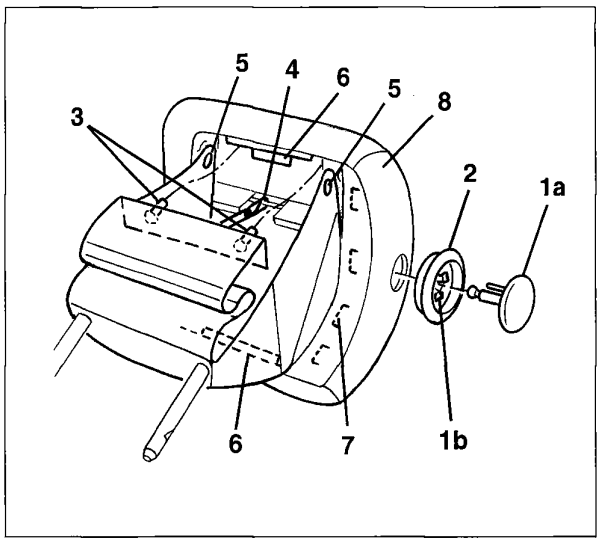
1. Carefully remove the lining and the padding.
2. Remove the headrest retaining sleeves and guide.

The sleeves must be replaced.

**NOTE** *To refit, reverse the operations used for removal.*



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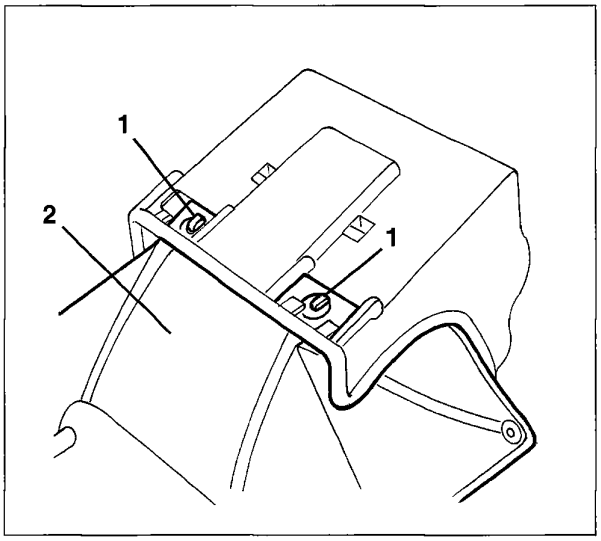



4F005EM01

## REAR SEAT CENTRAL HEADREST- Disassembly and reassembly

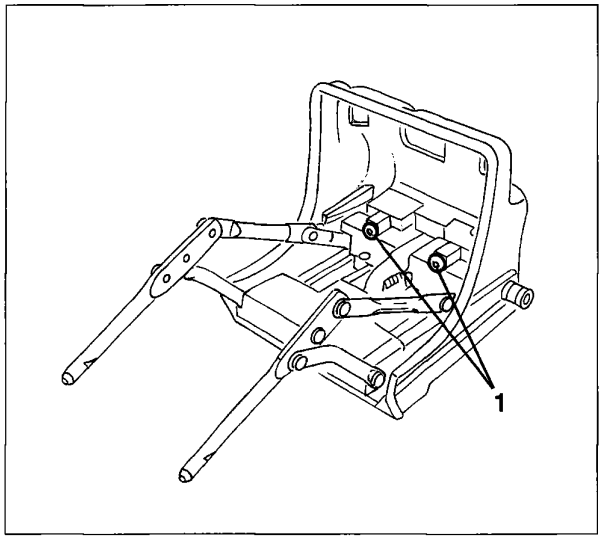
### Disassembly

1. Remove button (1a) pushing the retainers outwards (1b).
2. Remove the panel.
3. Disconnect the retaining pins from the bellows.
4. Disconnect the hook from the retaining.
5. Disconnect the side retainers from the bellows.
6. Disconnect the 2 lining retaining strips.
7. Remove the metal retaining points all along the edge of the lining.
8. Remove the lining and the padding.




4F005EM02

1. Turn over the headrest and disconnect the bellows from the retainers.
2. Retrieve the bellows.




4F003EM03

### Disassembly

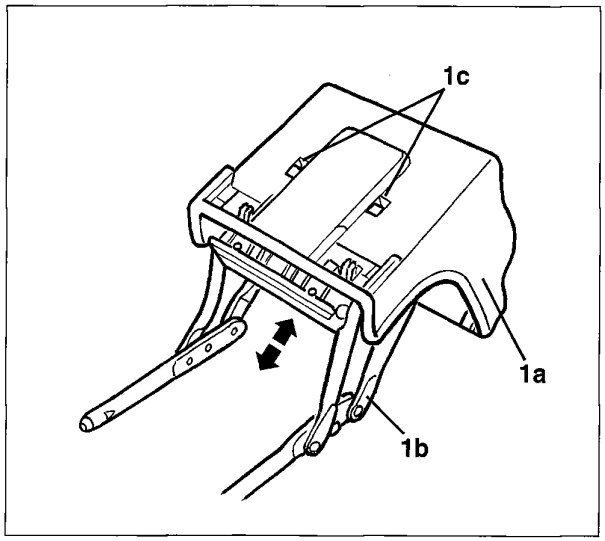
Use the following procedure to refit the lining.

1. Undo the bolts



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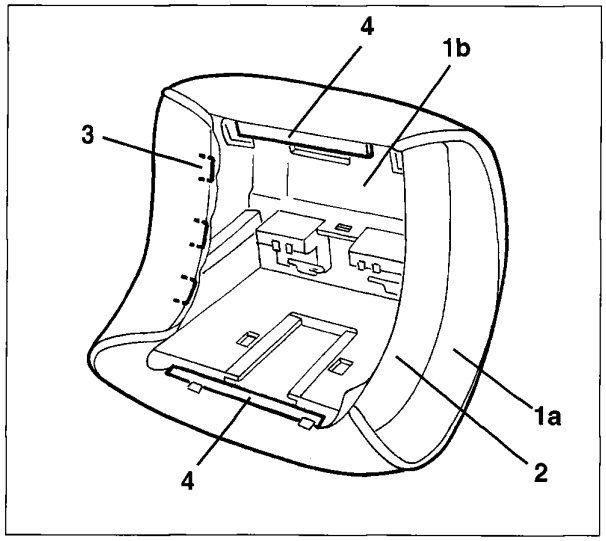
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4F006EM01

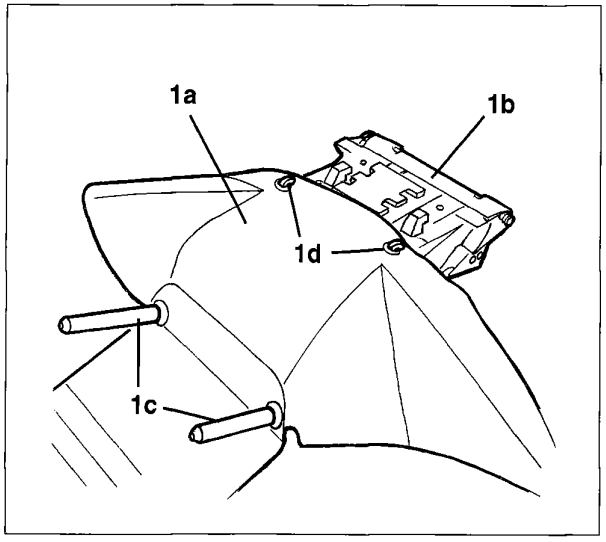
1. Turn over the headrest structure and remove casing (1a) from lifting mechanism (1b), disconnecting the retainers (1c), then move (1a) upwards (1a) following the arrow.

**NOTE** *When disconnecting the retainers (1c), proceed carefully in order to prevent breakages.*




4F006EM02

1. Fit padding (1a) onto casing (1b).
2. Fit the lining.
3. Fit the lining all along the edge using the metal fastenings.
4. Attach the 2 retaining strips on the lining.

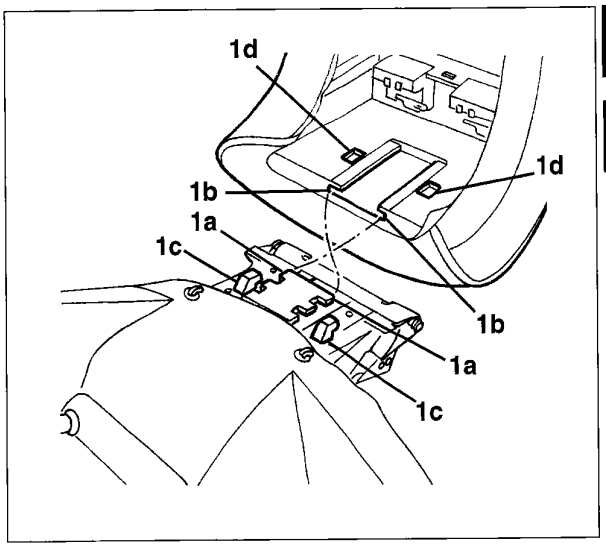



4F006EM03

1. Fit the bellows (1a) to the mechanism (1b) inserting the bellows onto the pins (1c), then connect to the retainers (1d).

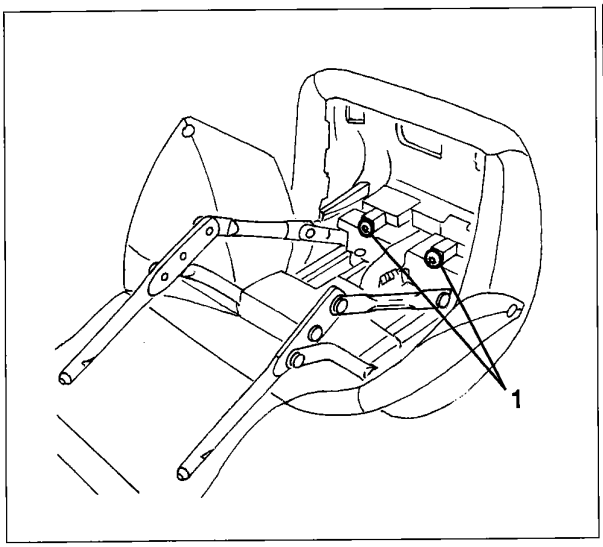


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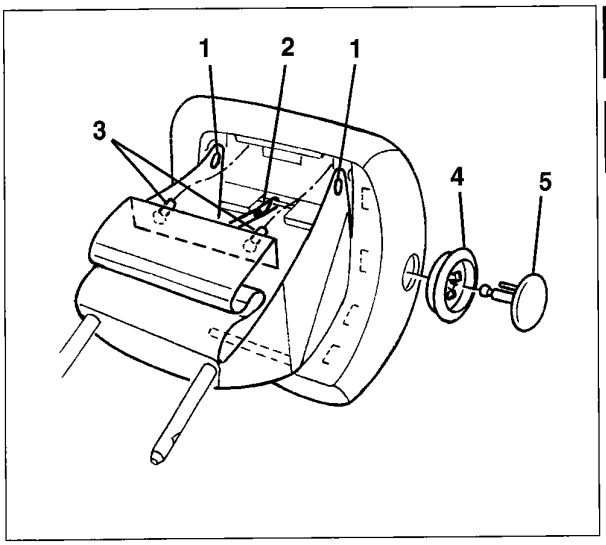

4F007EM01

1. Turn over the assembly and insert the guides (1a) into housing (1b) on the casing until retainers (1c) are engaged in the housings (1d).




4F007EM02

1. Tighten the bolts



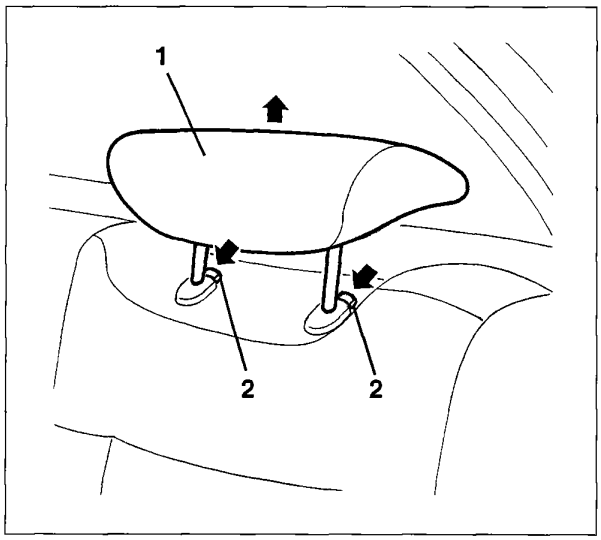

4F007EM03

1. Connect the bellows side retainers.
2. Connect the flexible retainer hook.
3. Engage the bellows retaining pins.
4. Fit the panel.
5. Fit the button.



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# 70.



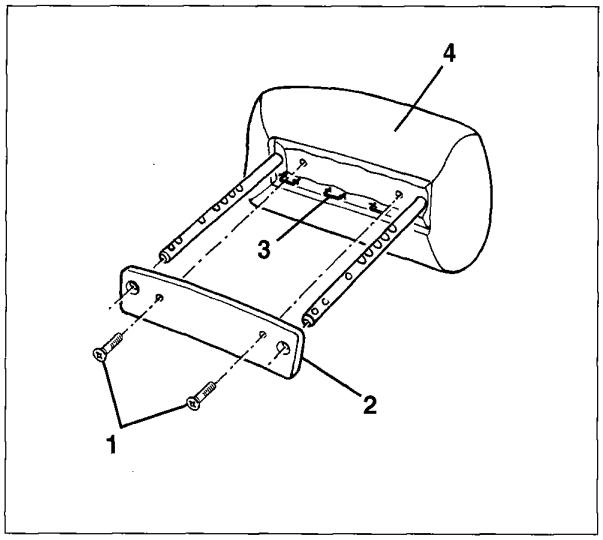

4F008EM01

## REAR SEAT SIDE HEADREST - R&R

### Removal

1. Lift the headrest to the end of its travel.
2. Push the retainers and remove the headrest.

**NOTE** *To refit, reverse the operations used for removal.*




4F008EM02

## REAR SEAT SIDE HEADREST - Disassembly

### Removal.

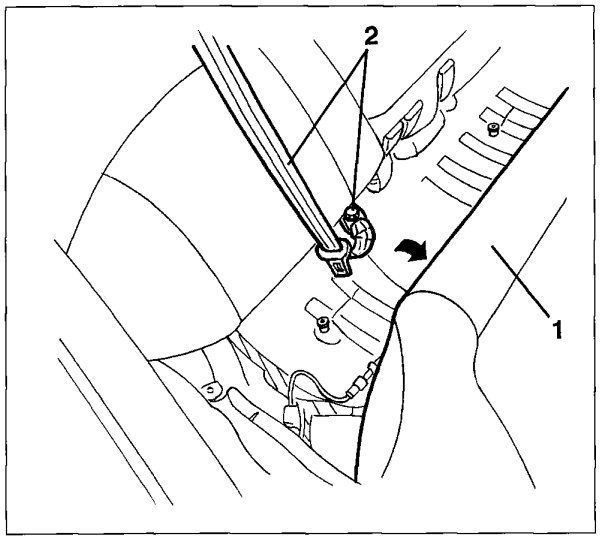
1. Undo the bolts
2. Remove the panel.
3. Remove the metallic fastenings.
4. Remove the lining and the padding.

**NOTE** *To refit, reverse the operations used for removal.*



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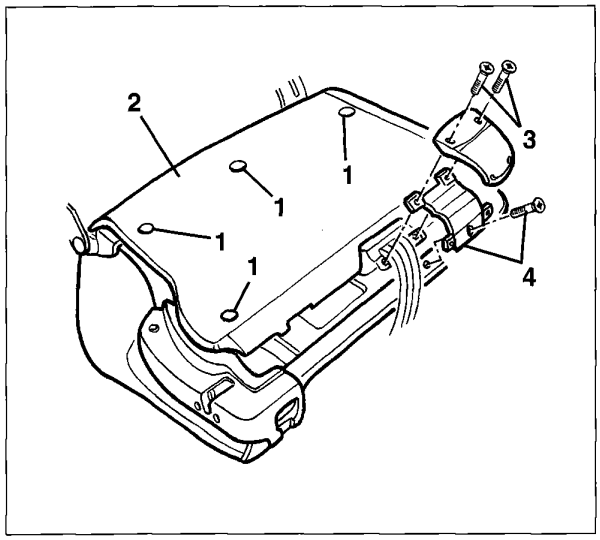
## CENTRAL REAR SEAT BELT WITH REEL - R & R.




4F009EM01

1. Remove the rear seat cushion.
2. Undo the bolts and remove the end of the seat belt.

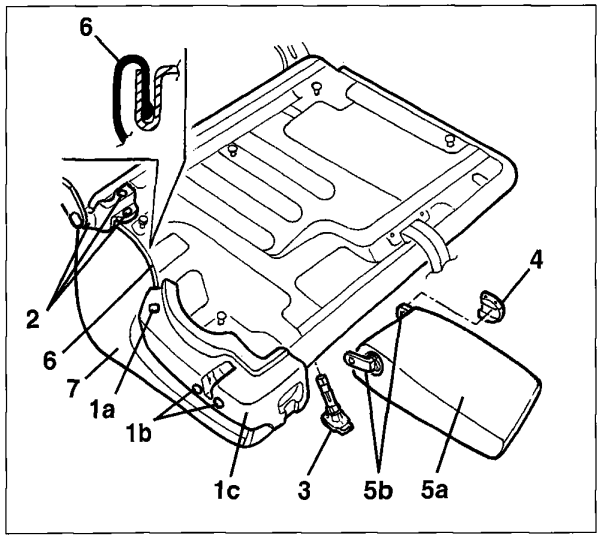
When reassembling, tighten to a torque of 4 daNm




4F009EM02

- Remove the rear seat headrest.
- Remove the rear seat back rest.

1. Remove the retaining pins.
2. Remove the backrest cover.
3. Undo the bolts and remove the cover.
4. Undo the bolt and remove the seatbelt slide.



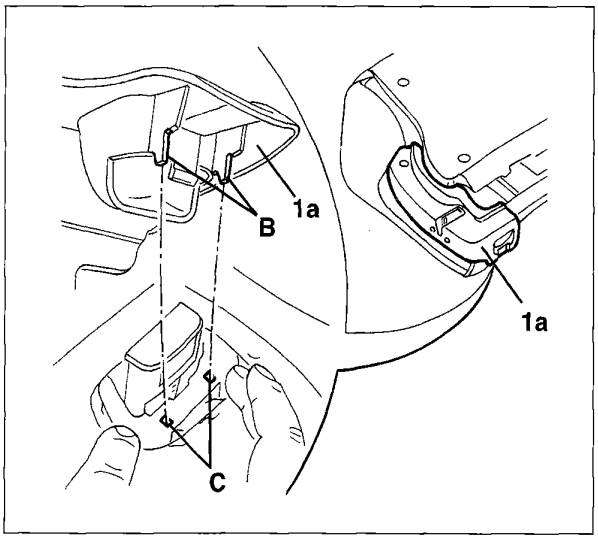

4F009EM03

1. Undo bolts (1a) and (1b) and remove the cover (1c) then retighten the bolts.
2. Undo the bolts and remove the anchoring bracket for the seat.
3. Remove the headrest sleeves.
4. Remove the armrest cover.
5. Remove armrest (5a) disengaging it from retainers (5b).
6. Remove the lining from all around the edge of the seat.
7. Remove the lining with the padding.



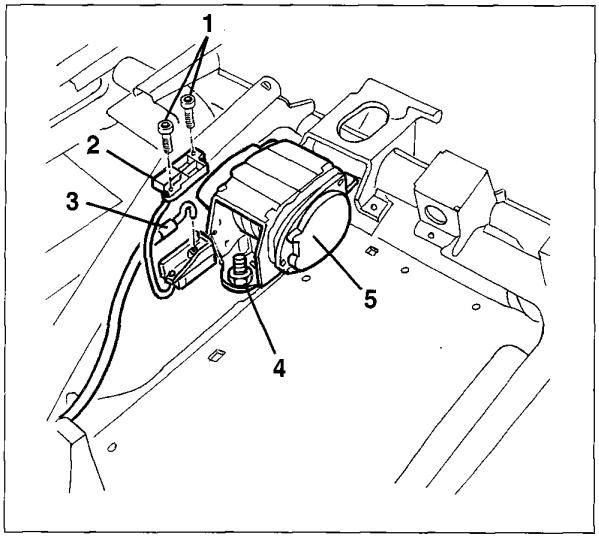
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# 70.




4F010EM01

1. When reassembling the cover (1a) check that the B retainers correctly insert into the corresponding C housings of the connection assembly.




4F010EM02

1. Turn over the seat frame and undo the cover retaining bolts.
2. Remove the cover.
3. Disconnect the seatbelt unhook control cable.
4. Undo the reel retaining nut.
5. remove the reel with seat belt.

**NOTE** *To refit, reverse the operations used for removal.*



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